THE IMPACT OF CLINICIAN-DIRECTED ENGAGEMENT PRACTICES ON COGNITIVE PERFORMANCE & PERCEPTIONS OF ALLIANCE AMONG INDIVIDUALS WITH ACQUIRED BRAIN INJURIES

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DISSERTATION ABSTRACT

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Title: The Impact of Clinician-Directed Engagement Practices on Cognitive Performance & Perceptions of Alliance Among Individuals with Acquired Brain Injuries

While clinical engagement is widely considered to be essential to the rehabilitation process, little empirical evidence exists examining the influence of engagement-enhancing practices on clinical performance. This dissertation study sought to evaluate the impact of a set of clinician-driven engagement practices, targeting key affective states, that practitioners can feasibly embed into rehabilitation sessions whose primary purpose was to improve cognitive-linguistic performance. A concurrent multiple-baseline design was implemented to determine changes in cognitive performance on a series of common neurorehabilitative tasks following exposure to identified practices across four participants who previously sustained acquired brain injuries. Examination into perceptions of therapeutic alliance, motivation, and self-efficacy were analyzed to determine perceptual shifts following exposure to engagement practices. The results suggest that promoting clinical engagement using a series of clinician-driven engagement practices enhanced participant performance. Improved performance was noted across all tasks, for each participant. While a single participant demonstrated a positive shift in perceived alliance, motivation, and self-efficacy, the remaining participants provided mixed responses. This study provides preliminary evidence that rehabilitation professionals can systematically

implement specific engagement-enhancing techniques and strategies that result in improved clinical outcomes.

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For Maddie, who aspired and inspires.

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CHAPTER I

Introduction

With the advent of person-centered care, rehabilitation professionals have transitioned from impairment-based clinical care to treatment that incorporates patient preferences when making clinical determinations (Håkansson et al., 2019; Forsgren et al., 2022). Person-centered care has highlighted the need for clinicians to take a more holistic approach to care (Eklund et al., 2019), including examination of how we interact and engage with patients (Granström et al., 2020). Known benefits associated with these relational shifts include improved patient satisfaction and rehabilitation outcomes (Yun & Choi, 2019; Krist et al., 2017). Targeted communication and engagement practices, such as providing encouraging feedback (Hillig et al., 2019) and performance reflection (Bland et al., 2016) have been shown to increase patient effort and motivation throughout the rehabilitation process. Such practices also help promote therapeutic alliance, or the affective bond between a patient and their clinician (Ferreira et al., 2013) which has been shown to improve patient outcomes in the mental health care field (Eliacin et al., 2018). A growing body of evidence indicates that patient engagement is essential to rehabilitative progress (Goverover et al., 2022; Williams et al., 2021). Despite these findings, engagement enhancing practices delivered by clinicians are considered ancillary, rather than active therapy ingredients in a treatment regimen (Laari et al., 2021; Ng, 2020; Liebrecht & Montenery, 2016).

Brain injury rehabilitation includes disciplines such as speech-language pathology, occupational therapy, and physical therapy, each with their own inherent goal domains (e.g., cognition, communication, activities of daily living, gross and fine motor skills), and all of which require sufficient client engagement in order for patients to make progress (Adey-Wakeling et al., 2021; Brett et al., 2017; Bland et al., 2016; Danzl et al., 2012). An important clinical question is whether progress may be optimized if clinicians use techniques that enhance a patient's commitment to therapy.

The purpose of this dissertation is to provide an experimental evaluation of the administration of clinician-driven engagement practices on cognitive rehabilitation task performance in participants with acquired brain injury. Chapter II reviews the literature relevant to underlying psychological states and their impact on patient performance. Theoretically grounded clinician behaviors that increase motivation, self-efficacy, and therapeutic alliance are described and comprise the independent variable for the study. Chapter III provides an overview of the study methodology. Chapter IV presents the results of the study, including associated figures and tables, as they pertain to each of the research question. Chapter V provides an interpretation of the study results, including clinical implications, study limitations, and concludes with directions for future research.

CHAPTER II

Literature Review

An Overview of Cognitive Rehabilitation

Cognitive rehabilitation refers to a range of interventions aimed at optimizing function in people experiencing cognitive changes after brain injury or disease (De Luca et al., 2018; Katz & Dwyer, 2021). It encompasses rehabilitation disciplines responsible for addressing changes in ability due to deficits in cognitive domains such as attention (Loetscher et al., 2019), memory (das Nair et al., 2016), organization (Bogdanova et al., 2016), communication (Cassel et al., 2019), and self-awareness (Nagele et al., 2021) resulting from neurological disease or trauma (Barman et al., 2016). Cognitive rehabilitation, typically administered by a neuropsychologist, speech-language pathologist (SLP), and/or occupational therapist (Bayley et al., 2014), begins by assessing underlying cognitive domains and processes impacted by a neurological injury (Taylor & Broomfield, 2013), which results in the development of a treatment plan, or intervention, to target identified deficits (Poulin et al., 2021; Bayley et al., 2014; Sohlberg et al., 2022).

Interventions developed to address cognitive deficits have evolved over time (Nudo, 2013). One major shift in cognitive rehabilitation is the move away from decontextualized, drill-based cognitive training protocols that emphasize brain stimulation exercises to treatments that directly target the functional impact of impairments (Gilmore et al., 2021; Barman et al., 2016). Functional cognitive rehabilitation centers on establishing naturalistic and meaningful treatment targets that enhance one's ability to reintegrate back into preferred and essential activities (Stephens et al., 2015; Wewiorski et al., 2018). Common intervention approaches include training in the use of external aids, such as phone applications that support memory deficits (Charters et al., 2015), or the utilization of cognitive strategies, such as pacing self-reminder techniques (Allendorfer et al., 2019). The use of attention drills in combination with cognitive strategy training has also been shown to be helpful in select patients (Markovic et al., 2020).

In addition to moving toward an emphasis on functional change, there has been a recent, albeit nascent, recognition that affective variables such as motivation, self-efficacy, and engagement are critical to rehabilitation outcomes (Oh et al., 2020; Torres et al., 2019). The possibility of increasing the effectiveness of cognitive rehabilitation interventions by promoting positive psychological states represents an exciting and novel area for investigation. Considerations of factors that enhance rehabilitation outcomes is essential considering the increasing prevalence of brain injury and challenges facing rehabilitation professionals.

The purpose of this dissertation is to evaluate the potential impact of directly targeting positive affective states through clinical engagement practices as part of the cognitive rehabilitation process. Below, a discussion of the prevalence and impact of brain injury highlights the need for effective cognitive rehabilitation. This is followed by a review of the practice context in which cognitive rehabilitation is currently delivered. Then an overview of the literature evaluating the drivers of therapeutic engagement and their potential relationship to rehabilitation outcomes is reviewed. The remainder of this chapter discusses the results from an exploratory, pre-dissertation pilot study examining the impact and feasibility of embedding a set of clinician-driven engagement practices into rehabilitation sessions whose primary purpose was to improve cognitive-communicative performance. The section concludes with presentation of the dissertation research questions.

Prevalence of ABI and Cognitive Impacts

Acquired brain injuries (ABIs) refer to an injury sustained to the brain after birth resulting from trauma, neurological disorder, or illness. ABI's are a major public health issue.

According to statistics collected by the Centers for Disease Control and Prevention (CDC), traumatic brain injuries (TBIs) account for 2.87 million emergency room visits (87%), hospitalizations (11%), and deaths (2%) annually (CDC, 2019), resulting in an estimated 98% of TBI survivors potentially qualifying for neurorehabilitative services. Valuations conducted by the CDC in 2010 estimated both direct and indirect medical costs to average $76.5 billion annually (CDC, 2019). Estimates have shown that approximately 65% of moderate to severe TBI patients contend with chronic cognitive challenges, while up to 15% of mild cases demonstrate long-term cognitive challenges (Rabinowitz & Levin, 2014). Among reported cases of TBI, 43% will experience long-term disabilities (Rabinowitz & Levin, 2014; CDC, 2019). Cerebral vascular accidents (CVAs), or stroke, serves as another predominant cause of neurological injury (CDC 2022; Fang et al., 2014). The CDC reports that more than 795,000 individuals in the United States are hospitalized for CVAs annually, with healthcare costs estimated to be $53 billion (CDC, 2022). In 2016, a survey conducted by the Stroke Association found that 77% of stroke survivors reported residual cognitive challenges (Tang et al., 2020). Regardless of the type of ABI sustained, recovery outcomes frequently result in chronic, long-term cognitive deficits that can have a devastating impact on numerous areas of functioning (Masel & DeWitt, 2010; CDC, 2015).

Challenges of Role Reintegration Following ABI. The ability to resume functional life roles following ABI is extremely challenging due to the expansive impacts affecting physical, emotional, psychological, and cognitive functioning (Spikman et al., 2010). ABI does not spare any one domain; therefore, a series of broad ranging physical, emotional, psychological, and cognitive consequences potentially diminish an individual's ability to functionally reintegrate back into essential roles and activities following ABI. Cognitive impairments associated with

ABI frequently result in disruption and inefficiencies affiliated with the completion of daily tasks and activities, including essential components necessary to sustain employment (Hart et al., 2019), reintegrate back into educational settings (Mealings et al., 2019), maintain social relationships (Steadman-Pare et al., 2001), and participate functionally within the household setting (Segev et al., 2018). Failure to engage successfully within these realms can have a persistent and devasting impact on an individual's quality of life (Steadman-Pare et al., 2001).

Vocational Challenges. Approximately 75% of individuals who sustain an ABI fall within a traditional employment age bracket (Foy, 2014, as cited in Donker-Cools et al., 2015). ABI is frequently associated with high rates of unemployment (Stocchetti & Zanier, 2016). Less than half of individuals with moderate to severe TBI are employed one-year post-injury, and that number does not significantly improve over time (Hart et al., 2010). Cognitive barriers have been identified as prohibitive when attempting to obtain or sustain employment post-ABI. Primary impairments impacting cognitive vocational rehabilitation include neuropsychological changes, poor awareness of impairments, deficits in memory and executive functioning skills, and breakdowns in both social communication and social cognition (Douglas et al., 2016).

Academic Challenges. Academic failure following brain injury is well documented across the ABI severity spectrum, including mild, moderate, and severe brain injury (Dematteo et al., 2015). The negative impact of ABI on academia is well documented across a variety of age ranges and academic settings. For instance, adult survivors of ABI often enroll in post-secondary education or professional training programs after their injury to begin, continue, or modify their career paths (Griffiths et al., 2015). An increasing number of these students are experiencing academic failure because of associated cognitive challenges that interfere with learning (Kennedy et al., 2008). Post-ABI deficits can include difficulties with listening, communicating, reading, writing, technological implementation/tolerance, sufficient attentional skills, content retention, verbal learning, problem solving, and socialization (Mealings et al., 2017).

Social Challenges. ABI populations are particularly prone to experiencing psychosocial difficulties resulting from cognitive deficits, such as making and sustaining relationships, and experiencing feelings of being misunderstood (Mealings et al., 2019). Correlations have been found between low social supports and overall reductions in perceived quality of life (Segev etal., 2018). Frequently, ABI results in impairments that limit effective social engagement due to decreased self-awareness, impaired self-regulation, and poor social cognition (Loya et al., 2017). The consequences of these impairments can threaten intact support systems (e.g., family members) and/or the development of new social networks (e.g., establishing relationships with potential co-workers), resulting in social isolation (Carlozzi et al., 2015). Decreases in social interactions can exacerbate post-injury psychological susceptibility to loneliness, isolation, and depression (Stocchetti & Zanier, 2016), which significantly impairs one's ability to effectively participate in rehabilitation activities due to the onset of complex psychological states, such as feelings of worthlessness (Warren et al., 2016).

Challenges in Activities of Daily Living. Activities of daily living (ADLs) encompass the various skills and abilities necessary to effectively manage essential daily activities independently (Edemekong et al., 2021). Many daily tasks, such as managing finances, preparing meals, shopping, and completing housework are dependent upon underlying cognitive functions, namely attention, memory, and executive functioning (Lee et al., 2021). Cognitive impairments can drastically impact one's ability to effectively and efficiently complete ADLs (Chandler et al., 2016). Inability to effectively participate in ADLs can result in decreased life satisfaction (Van Bost et al., 2019), quality of life (Bárrios et al., 2013), and role reintegration (Lee et al., 2021).

In summary, cognitive impairments have been shown to have widespread impact on individuals' abilities to pursue meaningful roles and activities. Cognitive rehabilitation is thus a critical part of the rehabilitation process. Developing service delivery approaches that can be optimally applied within the current rehabilitation landscape would help the many people experiencing changes following brain injury.

The Current Rehabilitation Landscape

Rehabilitation practices have evolved over the past decade in response to systematic changes impacting the delivery of care, transitioning from siloed care to recognizing the benefits of integrated care. This section provides an overview of the current state of rehabilitation and rehabilitation practices by describing barriers facing clinicians and discussing transitions in current approaches to clinical care in rehabilitation.

Systemic Constraints in Rehabilitation

A myriad of barriers can limit the effectiveness of rehabilitation. Time constraints, productivity standards, and insurance authorization has resulted in decreased access to care and limited services (Snoswell et al., 2020). Current funding mechanisms rely on standards that seek to limit hospitalizations and enrollment in rehabilitation treatment (Feng et al, 2020), which has caused in a decrease in the number of authorized sessions, despite an ever-increasing number of patients requiring complex treatments (Kilgore et al., 2017; Bank et al., 2015). As the number of patients has increased over the past decade, so have productivity standards clinicians have to maintain, requiring them to treat more patients throughout the workday with reductions in the time allotted for individualized, direct patient care (Bank et al., 2015). Consequences of time constraints and productivity pressures have resulted in decreases in the quality and accuracy of care, reduced awareness of psychosocial challenges facing patients, an increased need for repeated services, and poor patient satisfaction (Bennett et al., 2019; Konrad et al., 2010). Additionally, interprofessional collaboration has become increasingly restricted with significant limitations in one's ability to provide direct cotreatment with other allied health professionals (Smith et al., 2021). When developing cognitive rehabilitation treatment protocols, it is important to consider these resource challenges and ensure that treatments can be implemented within the constraints of today's healthcare market.

One positive result of the restrictions has been the encouragement of increased patient autonomy (Eassey et al., 2019), as patients need to independently compensate for decreases in access to skilled services to maximize clinical outcomes (Bland et al., 2020). To adapt to these systemic changes, while trying to ensure strong clinical outcomes, the rehabilitation field has had to shift towards partnering with patients in the delivery of their care.

The Person-Centered Care Movement in Rehabilitation

Rehabilitation professionals have historically followed a 'medical model' when making clinical determinations, which assumes that the remediation of an impairment serves as the primary goal in rehabilitation practices (White-Chu et al., 2009). Previously, treatment selection relied heavily on matching therapeutic activities specifically to categories of impairments (Hatfield et al., 2005). While this approach has face validity, it does not consider the whole person which can result in poor patient engagement and participation leading to restricted clinical outcomes throughout the therapeutic process (Medley & Powell, 2010). This recognition laid the foundations for the adoption of a person-centered care (PCC) approach. PCC is centered around the patient's individualized needs by partnering with the patient to incorporate their preferences when making clinical determinations (Ortiz, 2019; Eklund et al., 2019; van Dulmen et al., 2015). Eklund et al. (2019) conducted a systematic analysis that described the primary tenets of PCC as being a medical provider who embodies (1) empathy, (2) respect, (3) engagement, (4) relationship, (5) communication, (6) shared decision-making, (7) holistic focus, (8) individualized focus, and (9) coordinated care.

Limitations in PCC Implementation. In its current form, PCC primarily exists as a philosophical approach to care (Fazio et al., 2018; Coyne et al., 2018). In fact, there is no formalized or universally agreed upon guidance or training regarding the implementation of PCC (Moore et al., 2017; Kitson et al., 2013), resulting in significant variations in how clinicians interpret, elicit, and implement the described tenets of PCC (Moore et al., 2017). Analysis of the literature suggests that the primary application of PCC takes place at the onset of therapy, particularly when collaboratively establishing personalized clinical goals (Kucheria & Sohlberg, 2019; Sugavanam et al., 2013; Constand et al., 2014). While collaborative goal setting adheres to PCC, and has preliminary support, it has not been fully adopted throughout the field of rehabilitation (Cameron et al., 2018; Leach et al., 2010; McClain, 2005). PCC is broadly recognized beyond the stage of establishing goals, even though elements of PCC can feasibly be infused throughout the rehabilitation process. One of the largest gaps in PCC is while it recognizes affective states, it does not fully incorporate how clinicians can target critical affective states that drive patient engagement throughout the entirety of the rehabilitation process (Eklund et al., 2019).

An Overview of Engagement in Rehabilitation

Clinical engagement is generally defined as a patient's effortful commitment towards achieving rehabilitation goals through active participation in therapeutic activities in direct collaboration with their treatment provider (Bland et al., 2016; Lequerica et al., 2009). Patient engagement throughout the rehabilitation process has been identified as critical to achieving meaningful outcomes (Burns et al., 2018; Epstein & Street, 2008, Bright et al., 2015). A systematic review by Forgea et al. (2021) found that the literature supported a strong association between clinical engagement and improved rehabilitation outcomes. An additional study by Williams et al. (2021) evaluated the correlation between engagement during occupational therapy session activities and performance on session activities and functional outcomes. Results suggested that the level of engagement exhibited during therapy mediated the relationship between clinical performance and obtaining functional outcomes.

Hillig, Ma, & Dorsch (2019), conducted one of the few studies attempting to experimentally evaluate the potential impact of clinician communication and facilitation of patient effort on rehabilitation outcomes in the field of physical therapy. They examined the influence of increasing instructional specificity utilizing goal-oriented instruction and its impact on exercise effort among 24 participants enrolled in a neurorehabilitation program. However, they established a third condition in which the clinicians added encouraging statements during exercise implementation. While goal-oriented instruction resulted in significant increases in the rate of exercise repetition, the addition of verbal encouragement resulted in even greater performance outcomes. This dissertation also seeks to evaluate whether a series of evidence-based engagement practices influences outcomes when applied to individuals receiving cognitive rehabilitative services.

The following section reviews the existing literature base examining the role of engagement in cognitive rehabilitation. Discussion will focus on identified facilitators and barriers of engagement, including critical affective ingredients. The section will conclude with the introduction of a graphic illustration that proposes facilitators of engagement specific to rehabilitation contexts.

Engagement in Cognitive Rehabilitation

Available literature discussing the impact of engagement specific to cognitive rehabilitation is scarce. The literature base is primarily housed within the fields of psychology, physical therapy, and occupational therapy. Engagement research related to cognitive rehabilitation has primarily focused on evaluating clinical engagement in individuals with dementia or studying the influence of technology on patient engagement. For instance, an interdisciplinary team of allied health professionals developed Neurocognitive Engagement Therapy (NET) to increase clinical engagement among individuals with dementia (Howanitz et al., 2018). While NET and alternative dementia-focused engagement protocols have some preliminary support, they rely heavily on components of reminiscence therapy, which is not applicable to non-dementia populations. Technology-based cognitive engagement interventions have been shown to increase task engagement among a broader spectrum of ABI populations (Golliot, 2019; Mihuta et al., 2018), but examination only extends into engagement within specified technological tasks. Limitations in available evidence into engagement practices within cognitive rehabilitation underscore the need to investigate methods of optimizing rehabilitative processes.

Factors That Facilitate Engagement

Existing research into engagement practices within rehabilitation settings has primarily been conducted by allied health professionals, namely in the fields of mental health and physical rehabilitation (Bright et al., 2015). Findings have shown that engagement is influenced by a series of contextual and relational factors driven by a clinician's approach to care (Forgea et al., 2021; MacDonald et al., 2013; Lequerica et al., 2009).

Research has identified a number of faciliatory factors that can be applied within rehabilitation contexts. Forgea (2021) and MacDonald et al. (2013) each conducted systematic reviews to identify associated factors that facilitate patient engagement throughout the rehabilitation literature. It should be noted that both reviews focused specifically on stroke rehabilitation and most studies that met inclusionary criteria were not aimed at solely examining clinical engagement, but engagement served as a component of the identified studies. MacDonald et al. (2013) identified seven clinician-driven factors that contribute to clinical engagement across the literature: (1) establishing meaningful goals, (2) developing a strong therapeutic alliance, (3) personalizing treatment, (4) applying a person-centered approach to care, (5) establishing patient autonomy, (6) delivering clear and meaningful education, and (7) providing encouraging performance feedback. The follow-up review by Forgea (2021) found agreement with most factors identified in the previous review, but included additional themes related to of self-efficacy. One of the challenges is that the identified factors were neither operationalized nor discrete. For example, person-centered care lacks a definite definition and broadly encompasses respecting patient autonomy (Mapes et al., 2020). An additional survey study conducted by Lequerica et al. (2009) was analyzed to compare findings from the systematic reviews with a survey of rehabilitation professionals used to identify perceived facilitators of patient engagement. See Table 1 for a comparison of findings across studies.

Table 1

Facilitators of Rehabilitation Engagement

Facilitators of engagement	Forgea (2021)	MacDonald et al. (2013)	Lequerica et al. (2009)
Autonomy	X	X	X
Concentration	X		
Facilitate success			X
Meaningful goals	X	X	X

Table 1, continued

Facilitators of engagement	Forgea (2021)	MacDonald et al. (2013)	Lequerica et al. (2009)
Self-efficacy	X		
Therapeutic connection/rapport/alliance	X	X	X

As previously noted, many of the identified approaches that support engagement are implemented at the beginning of the therapeutic process. For instance, the strongest evidence in the rehabilitation field demonstrating a clinician behavior that resulted in increased clinical engagement was implementing collaborative goal setting at the start of the therapy (Kang et al., 2021; Knutti et al., 2022; Plant et al., 2016). There is a gap in the literature examining ongoing behaviors that influence engagement throughout the therapeutic process.

Barriers to Engagement

It is critical to consider barriers as well as facilitators of clinical engagement within neurorehabilitation. Reduced levels of engagement can result in a myriad of challenges following brain injury (Williams et al., 2021), including a reduction in functional improvements (Draper et al., 2020). While systemic barriers were previously described, ABI frequently disrupts cognitive and psychosocial systems that result in unique sequela that can impair an individuals' ability to engage in therapeutic activities and achieve meaningful outcomes (Williams et al., 2021; Brett et al., 2017; Knutti et al., 2022). Table 2 provides an overview of identified barriers to engagement associated with ABI.

Table 2

Barriers to Engagement Following ABI

Barriers	References
Increased rates of anxiety/depression	Hesdorffer et al., 2009; Whelan-Goodinson et al., 2008
Irritability/aggressive behavior	Fleminger, 2008; Yang et al., 2012
Difficulty/discomfort with socialization	McDonald et al., 2008
Poor self-awareness	Prigatano, 2005; Medley & Powell, 2010

Table 2, continued

Barriers	References
Impaired executive functioning	Cazalis et al., 2006
Compromised and diminished communication skills	Struchen, 2008; Safaz et al., 2008
Survivors' focus on deficits and comparison with pre-injury functioning	Kreutzer et al., 2010
Cognitive deficits	Williams et al., 2021; Tonks et al., 2011
Denial/anosognosia	Choi & Twamley, 2013

The literature also acknowledges a series of barriers to clinical engagement independent of ABI symptoms or systemic origins. A common challenge in many rehabilitation settings is boredom, particularly among individuals' temporarily or permanently residing in medical facilities (Kenah et al., 2018). Boredom frequently results in an inability to engage in therapeutic activities, notably activities that are not perceived as meaningful, under stimulating, or too challenging (Kenah et al., 2021). Establishing a clear understanding of the value and intent of a therapeutic activity is critical (Hillig et al., 2019; Yardley et al., 2016). When clinicians do not provide a clear rationale of task value, it can serve as a barrier to task engagement (Colaianni & Provident, 2010).

Psychological beliefs and attitudes can also challenge a person's ability to engage in rehabilitation. For instance, a defeatist psychological schema can result in low self-efficacy and establish expectations of failure that diminish engagement (Choi et al., 2013). Psychological attitudes have been found to directly impact patient motivation and result in the diminishment of an individuals' capacity to engage in the rehabilitation process (Poltawski et al., 2015; Chan et al., 2017; Miller & Moyers, 2017). The client's psychological or affective states along with their belief about the importance and rationale of the therapy are two primary barriers to engagement that could potentially be mitigated by techniques that effectively target productive affective states during the rehabilitation process.

Potent Affective States

A number of rehabilitation researchers have identified client affective states that enhance rehabilitation performance. Investigations into affective states have revealed that they can directly impact how a patient engages throughout the rehabilitative process, suggesting that it is important for clinicians to understand and attend to a clients' disposition toward therapy (Burns et al., 2018; Bright et al., 2015). The systematic review by Forgea (2021) concluded that associated factors known to enhance clinical engagement in rehabilitation could be categorized into two primary affective facilitators of engagement: motivation and self-efficacy.

Motivation. Motivation is responsible for an individual's drive, including their initiation and persistence towards achieving goal-directed behaviors and outcomes (Ryan & Deci, 2020). Motivation has been conceptualized through various theoretical frameworks. Two commonly referenced motivational frameworks are Self-Determination Theory (SDT) and Social Cognitive Theory (SCT). SDT postulates that motivation is derived from a combination of intrinsic (internal) and extrinsic (external) influences (Orsini et al., 2016; Gagné & Deci, 2005). Following brain injury, many of the barriers described in Table 2 can interfere with intrinsic and extrinsic drivers of motivation (O'Neil-Pirozzi et al., 2019). For instance, compromised cognitive skills, such as poor insight or awareness, may result in significant variability in one's readiness and motivation to engage in critical health-related behavior changes (Berkman, 2018; Spruit et al., 2015; Kusec et al., 2018). SCT posits that motivation is driven by one's belief in their own agency and is influenced by social and environmental factors (Schunk & DiBenedetto, 2020; Bandura, 2001). Following brain injury, motivation to participate in therapy is likely to increase when a clinician promotes agency and other drivers of motivation and engagement, resulting in increased associated outcomes (Reid et al., 2015). The therapeutic relationship can serve as a mechanism to promote the belief that patients can make meaningful improvements (Schunk & DiBenedetto, 2020).

Evidence has shown that motivation is a critical driver throughout the rehabilitation process (O'Neil-Pirozzi et al., 2019; Boosman et al., 2016; Winkens et al., 2014). A lack of motivation is common among patients with ABI (Boosman et al., 2016), and can be detrimental to key rehabilitation drivers resulting in poor clinical and functional outcomes (Goršič et al., 2017; Cheong et al., 2021). At the start of therapy, motivational factors serve as an important consideration when developing a care plan to assist with clinical engagement when establishing goals and during the treatment selection process (Kusec et al., 2018). Motivation is also associated with persistence behaviors, such as maintenance of an established intervention or strategy (O'Neil-Pirozzi et al., 2019) and overall treatment adherence (Park et al., 2016).

Cheong et al. (2021) conducted a literature review to identify internal and external factors related to the promotion of motivation in rehabilitation. Internal factors included (1) depression, (2) cognition, (3) self-efficacy, (4) self-esteem, (5) disability acceptance, (6) volition, (7) communication, (8) resilience, (9) empowerment, and (10) uncertainty. External factors included (1) quality of life, (2) sleep patterns, (3) participation in activities of daily living, (4) social supports, and (5) financial burdens. Identified factors were shown to have a strong correlation with rehabilitation motivation and subsequent outcomes. Additionally, the authors highlighted the importance of social supports as a critical externalized factor. They posited that the support of healthcare providers could serve to improve rehabilitation motivation and effectiveness. Despite these findings, investigations into external factors that drive motivation among individuals who sustained ABIs have not been as widely studied, as compared with internal variables (Kusec et al., 2019).

Self-Efficacy. Self-efficacy is one's belief in their ability to successfully navigate and execute their own actions and decisions (Huang, 2016; Bandura, 2001). Bandura (1997) proposed four systems that influence one's ability to assess and determine their capabilities: (1) mastery experiences, (2) vicarious experiences, (3) verbal persuasion, and (4) physiological and affective states. When each of these systems converge and positively validate one another, that results in increased self-efficacy (Pfitzner-Eden, 2016). Table 2 lists factors related to brain injury that can impair a person's ability to establish and maintain self-efficacious beliefs. For instance, a perseverative comparison with one's pre-injury status could result in an inability to recognize clinical mastery and gains made throughout the rehabilitation process (Banerjee et al., 2021). A study by Harmon et al. (2014) found that self-efficacy is likely to increase within rehabilitation contexts when (1) a trusting alliance has been established between the patient and clinician, (2) patients recognize the need for treatment and actively engage in therapy, (3) and the plan of care is mutually agreed upon.

Rehabilitation research has shown a strong correlation between efficacious beliefs and positive performance outcomes (Torrisi et al., 2018; Man et al., 2013; Patel, 2017). Increased levels of self-efficacy have associations with improved quality of life (Cicerone & Azulay, 2007), rehabilitation engagement (Forgea, 2021; Choi & Twamley, 2013), socialization (Brands et al., 2017), coping (Brands et al., 2015), and management of symptomology (Brands et al., 2017). In fact, a person's self-efficacy has been found to be predictive of health-related outcomes (Loo et al., 2016; Williams & Rhodes, 2016; Thomet et al., 2018). While ABI can result in negative belief patterns resulting from cognitive, psychosocial, and/or physical challenges (Parker et al., 2018), rehabilitation providers can combat negative attitudes by instilling patients with the belief that they can accomplish realistic and meaningful goals based upon their post-ABI status and abilities (Selzler et al., 2016).

The primary body of rehabilitation research has examined the relationship between self-efficacy and clinical outcomes, as opposed to identifying factors that directly enhance self-efficacy (Sakamoto et al., 2021). To date, Choi and Twamley (2013) have conducted the only known systematic review of self-efficacy interventions in cognitive rehabilitation. While their study centered on dementia populations, they identified a series of clinical approaches that can be applied within any cognitive rehabilitation context to enhance a patient's self-efficacy and clinical engagement. Identified approaches include (1) increasing the value of tasks through individualization and personalization, (2) linking tasks with meaningful goals, (3) involving social and environmental support systems, and (4) directly targeting motivation.

As described in SCT, self-efficacy can drive motivation (Kelly & Greene, 2014), particularly intrinsic motivation (Williams & Rhodes, 2016; Reaves et al., 2018; Ortiz Rojas et al., 2017), indicating a dynamic interplay between the two affective states. Engagement researchers have found significant associations between motivation, self-efficacy, and engagement (Wu et al., 2020; Dogan, 2015; Granziera & Perera, 2019). For instance, a study by Slovinec D'Angelo et al. (2014) found that both motivation and self-efficacy enhanced health-related behavior changes critical to rehabilitation outcomes, such as exercise adherence.

Therapeutic Alliance. Therapeutic alliance is the sense of connection or bond that a patient perceives with their clinician (Babatunde et al., 2017). Alliance has been shown to be a strong determiner in promoting motivation, self-efficacy, and patient engagement (Lawton et al., 2016; Stagg et al., 2021). When an effective therapeutic alliance has been established, the patient is more likely to trust that the clinician has selected meaningful and feasible treatments, which helps to support the establishment of motivation and self-efficacy (Iwanaga et al., 2019). The working relationship between a patient and their provider can serve as the conduit through which engagement is established and maintained (Stagg et al., 2019).

The engagement literature supports that engagement is co-constructed between a patient and their provider (Bright et al., 2015). However, the burden of establishing a meaningful therapeutic alliance typically falls on the clinician (Lawton et al., 2018). Stagg et al. (2021) found four primary facilitators of therapeutic alliance among brain injury rehabilitation professionals: (1) enabling interactions, (2) being responsive, (3) building relational capital, and (4) building credibility. Despite these findings, the influence of the role of the clinician within rehabilitation contexts has been grossly understudied (Stagg et al., 2021). Fortunately, the counseling and psychology fields have conducted a significant amount of research into the value of the role of the clinician relevant to the field of brain injury rehabilitation. Lambert's Common Factors Model (1992) was designed to estimate outcome variance based on a series of four factors: (1) client factors, (2) the therapeutic relationship, (3) the therapeutic model, and (4) the hope/placebo effect (Lambert & Bergin, 1992). It is estimated that the therapeutic relationship, or alliance, accounts for 30% of outcomes (Gehart, 2010). There is an increasing recognition among researchers and clinical practitioners that relational factors are inseparable from applied interventions (Miller & Moyers, 2015).

A strong therapeutic alliance can enhance both motivation (Roest et al., 2016) and self-efficacy (Lawford et al., 2019). As described, the literature has identified additional clinical behaviors that promote motivation, self-efficacy, and ultimately engagement in therapy processes (Essery et al., 2017). While the literature provides models and facilitators of clinical engagement, there has not been experimental evaluation of the potency of clinician generated engagement behaviors other than collaborative goal setting in cognitive rehabilitation (Williams, et al., 2021). Building on preliminary pilot work described in the next section, I posit that clinicians can feasibly facilitate engagement throughout the entirety of the cognitive rehabilitative process by implementing theoretically grounded behaviors associated with increasing motivation and self-efficacy, while promoting therapeutic alliance. Therefore, it is reasonable to expect that if a clinician actively targets the establishment of therapeutic alliance and implements strategies that drive motivation and self-efficacy, then clinical engagement would increase.

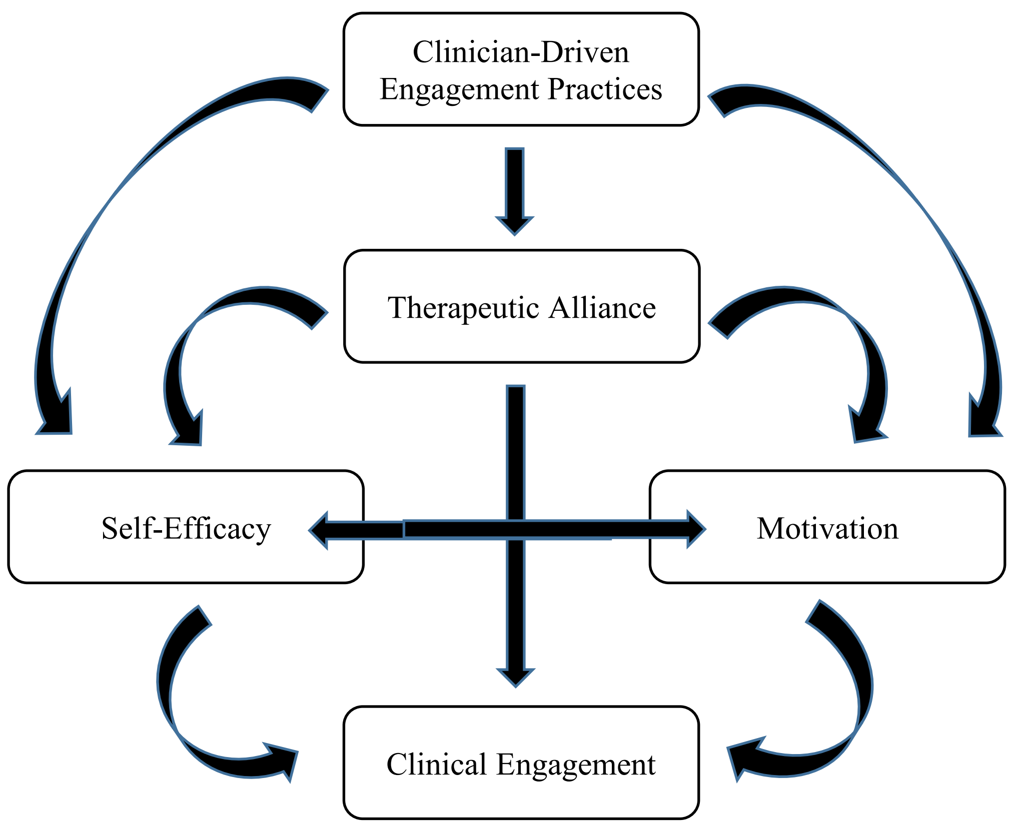
Drivers of Therapeutic Engagement in Rehabilitation

Lequerica and Kortte (2010) proposed a theoretical model of clinical engagement processes specific to the field of medical rehabilitation. The model was developed from the Health Action Process Approach (HAPA) and provides a framework for understanding health-related behavior change. The Lequerica and Kortte model establishes a feedback loop in which patients reassess treatment through analysis of a series of internal and external variables to determine whether to establish and maintain engagement in therapy or disengage. Internal variables are described as one’s perception of a need for treatment, outcome expectancies, and perceived self-efficacy, which drives an individual’s willingness to participate in treatment. If willing, externalized factors, represented by goal setting and treatment planning, combine with established internal factors to motivate that individual to actively engage in treatment processes. While the model illustrates the potential impact of enhancing internal states relevant to motivation and self-efficacy, it does not sufficiently describe external mechanisms that enhance internal states. Important external mechanisms to consider are the establishment of a therapeutic alliance and influence of clinician-driven engagement practices on motivation and self-efficacy (Stagg et al., 2021; Stagg et al., 2019).

A modified graphic illustration detailing the relationship and interplay between key drivers of clinical engagement is presented in Figure 1. The graphic streamlines existing components of the Lequerica and Kortte model, while incorporating clinician-driven engagement practices and therapeutic alliance. Clinician-driven engagement practices serve as the overarching driver of therapeutic alliance, motivation, and self-efficacy. The bidirectional influence of key affective states is highlighted in the graphic, which also notes that an increased sense of therapeutic alliance enhances motivation and self-efficacy, resulting in the establishment of clinical engagement.

Figure 1

Graphic Illustrating Drivers of Clinical Engagement



A Pilot Investigation into Engagement in Cognitive Rehabilitation

A pre-dissertation pilot study (Rothbart & Sohlberg, in submission) was conducted to determine the feasibility and efficacy of infusing clinician-driven engagement practices during cognitive rehabilitation sessions. There were two research questions addressed in the pilot study. The primary research question examined the potential impact of clinician-driven engagement practices during the administration of cognitive rehabilitation drills on drill performance. In order to understand the findings, a secondary research question examined whether patients felt greater alliance with the clinician when engagement practices were delivered. It was hypothesized that the application of clinician-driven engagement practices would enhance clinical performance and result in improved perceptions of alliance.

The study consisted of an exploratory, non-concurrent multiple-baseline design comprising a baseline and intervention phase designed to evaluate whether the addition of a single variable, application of clinician-driven engagement factors, changed performance on a series of attention drills across three participants. The engagement behaviors were identified by reviewing the extant, but limited research that described methods to increase client performance by promoting motivation, self-efficacy, and therapeutic alliance (see Table 3) (Kreutzer et al., 2018; Chmitorz et al., 2017; Neils-Strunjas et al., 2017). During the baseline condition, the clinician administered the drills according to an automated program without any added engagement with the client. Following baseline, the clinician administered the drills according to program directions with the addition of the identified engagement facilitation behaviors. The results were analyzed using visual and quantitative analysis to determine whether the addition of the engagement factors suggested that promoting clinical engagement using a series of clinician-driven engagement practices enhanced participant performance.

Table 3

Pilot Study Clinician-Driven Engagement Practices

Key Engagement Targets	Clinical Application
Motivation	☐ Establish functional and task-specific goals ☐ Provide specific and encouraging feedback/affirmations
Self-Efficacy	☐ Provide opportunities for reflective thinking
Therapeutic Alliance	☐ Demonstrate reflective listening ☐ Application of bonding statements ☐ Conduct check-ins

Attention Drill Results

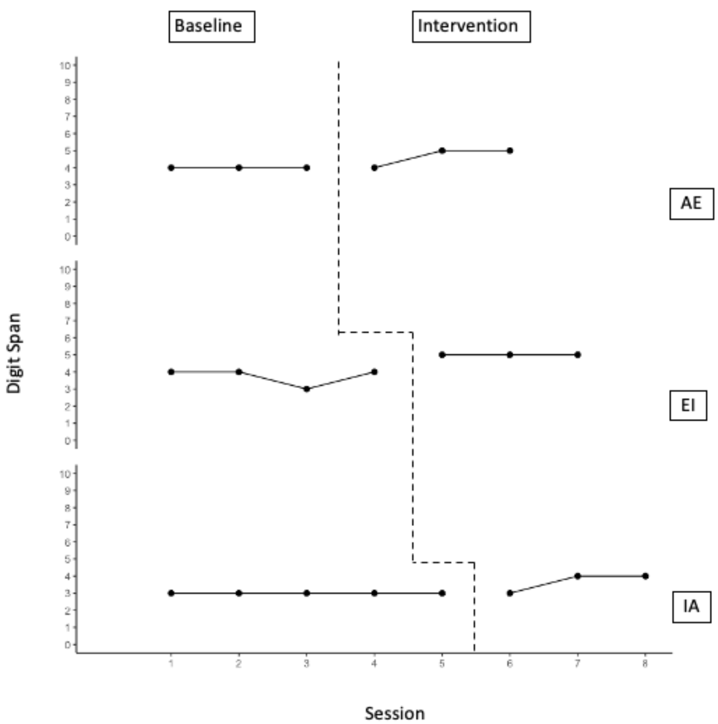
Attention drill performance data were graphed to facilitate visual analysis of length of correct stimulus strings (digit span and word span) between both phases for each individual participant (Horner et al., 2005). Observations were made regarding changes in level, trend, and immediacy of effect. Two effect size calculations were utilized to determine potential statistical differences between performance on attention drills in the baseline and intervention phases: (1) Percentage of Non-overlapping Data (PND) (Parker et al., 2011) and (2) *Tau*-U (Newson, 2002; Parker et al., 2011).

Digit Span Results

Figure 2 displays the plotted digit span performance across all three participants. Stable baseline data were observed across all three participants with slight volatility in the observed stimulus length for Participant EI during sessions 3 and 4. Immediacy of effect with the administration of the clinician-driven engagement practices was only present for participant EI; however, all three participants demonstrated a change in level supporting the existence of a functional relation. According to single-case experimental design, a functional relation is indicated when visual analysis demonstrates treatment effects across a minimum of three points in time (Kratochwill, 2010; Horner, 2005). The obtained PND effect size was observed to be 0.778 across the three participants corresponding to an effective intervention, and the *Tau-U* calculation obtained a score of 0.807, corresponding with a significant effect, according to benchmarks established by Parker (2011).

Figure 2

Digit Span Stimulus Length Data



Word Span Results

Figure 3 displays the plotted word span performance across all three participants. Stable baseline data was observed across all three participants. Immediacy of effect and change in level in the treatment condition were observed for all participants, and participants EI and IA demonstrated a rising trend supporting the existence of a functional relation. Effect size calculations additionally supported the existence of a functional relation. Both PND and *Tau-U* calculations generated an effect size of 1.0, corresponding to a significant effect, according to Parker (2011).

Figure 3

Word Span Stimulus Length Data

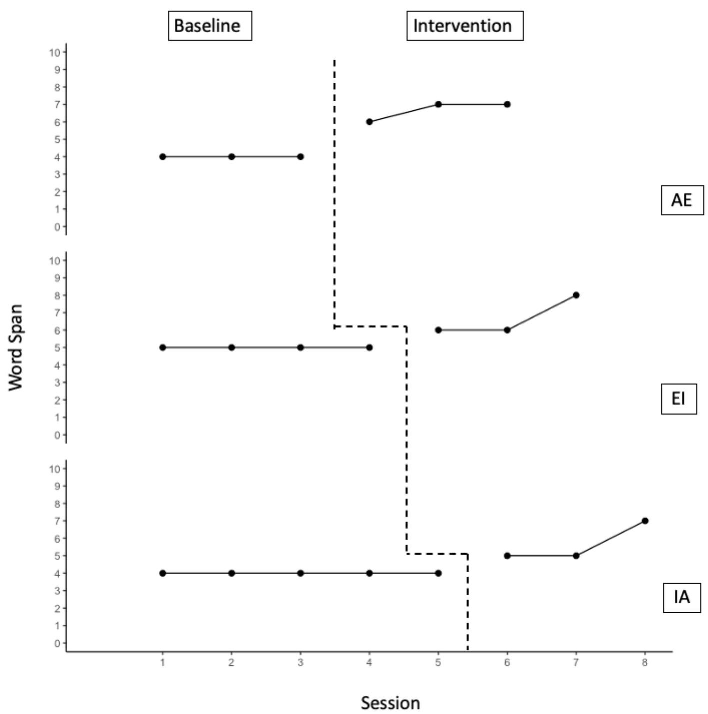


Table 4

Summary of Visual Analysis

Participant	Level change		Increasing trend		Variability		Immediacy of effect		Overlap	
	BL	TX	BL	TX	BL	TX	BL	TX	BL	TX
AE	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No
EI	Yes	Yes	No	Yes	No	No	Yes	Yes	No	No
IA	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No

Note. BL = baseline phase; TX = treatment phase

Table 5

Summary of Quantitative Analysis

Value	Digit span sequence scores	Sentence span sequence scores
Tau-U	.8065	1.0
PND	.778	1.0
p-value	.0034	.0003

Note. Tau-U and PND (Parker, 2011); $p < .05$

WAI Results

A dependent measures t-test was conducted to compare pre-post outcome measures utilizing participant responses on the WAI. Data for each participant were analyzed independently. Only IA appeared to have a significant change in alliance as measured by the WAI, although the other two were in the expected direction. The results from the pre-test (M = 5.194, SD = 1.305) and post-test (M = 5.750, SD = 1.339) does not indicate a statistically significant change for participant AE, $t(35) = -1.944$, $p = 0.059$. Similarly the results from the pre-test (M = 5.667, SD = 1.219) and post-test (M = 6.17, SD = 1.183) does not indicate a statistically significant change for participant EI, $t(35) = -1.948$, $p= 0.059$. However, the results from the pre-test (M = 5.722, SD = 1.504) and post-test (M = 6.667, SD = 0.676) does indicate a statistically significant change for participant IA, $t(35) = -3.141$, $p = 0.003$.

Table 6

Quantitative Analysis of WAI Data

Participant	Mean	SD	*p*-value
AE	5.194	1.305	.059
EI	5.667	1.219	.059

Table 6, continued

Participant	Mean	SD	*p*-value
IA	5.722	1.504	.003

Note. SD = standard deviation; $p < .05$

Improved performance was noted across all attention tasks, for each participant, providing preliminary evidence that a functional relation exists between clinician-driven clinical engagement practices and patient performance during neurorehabilitation tasks. Only one participant demonstrated a significant shift in perceived alliance between conditions. However, the remaining two participants showed changes in therapeutic alliance in the expected direction.

Selection of Engagement Strategies for Current Study

The results of the pilot study encouraged further exploration and helped guide planning for the current dissertation. A key task for planning the follow-up dissertation experiment was the selection and refinement of engagement strategies. In the pilot study, strategies were selected by looking at the literature and selecting strategies with support that appeared feasible to implement within cognitive rehabilitation sessions whose primary purpose was to deliver exercises designed to improve cognitive performance. Selected strategies were informally vetted by clinicians, who judged them to be feasible and impactful. Given the positive findings of the pilot study, those strategies were also considered for use in current dissertation study.

The literature review described in this chapter helped to refine and identify additional potential clinician-engagement strategies. There are several additional engagement enhancing strategies that could have been selected for the dissertation based on the literature. For example, establishing personalized and meaningful patient goals has been shown to enhance clinical engagement (Dekker et al., 2020; Kucheria et al., 2022). However, strategies in this category did not fit the current study which examined the effect of the strategies on performance of pre-selected treatment activities. The literature review did identify three additional strategies, described below that could be feasibly implemented in a therapy session targeting implementing rehabilitation exercises.

Table 7 describes the clinician-driven engagement practices evaluated in this study. As previously depicted in Figure 1, there is conceptual overlap between the two affective states, motivation and self-efficacy, as well as the influence of the relational construct of therapeutic alliance. Therefore, strategies might be categized within multiple domain areas. For the purpose of the current dissertation study, motivation was targeted by incorporating performance encouragement and the utilization of patient-clinician collaboration to establish task buy-in (Cicerone et al., 2019; Hillig, Ma & Dorsch, 2019; Kucheria et al., 2022). Self-efficacy was promoted by encouraging the use of self-generated strategies or behaviors to enhance performance, providing opportunities to make choices regarding task execution, incorporating performance prediction, and embedding reflective check-ins (Medalia, Herlands, Saperstein, & Revheim, 2017; Beahm, McCall, Carleton, Titov, Dear, Hadjistavropoulos, 2021; Cowden & Meyer-Weitz, 2016; Klein, Drummond, Mhizha-Murira, Mansford, & das Nair, 2019). Therapeutic alliance was fostered through expressions of positive regard, incorporating binding statements, and providing demonstrations of active listening (Essery et al., 2017; Stagg et al., 2021; Stagg et al., 2019). The package of strategies is described in Table 7.

Table 7

Identified Clinician-Driven Engagement Practices

Key engagement targets	Clinician-driven engagement practices
Motivation	(a) Task Buy-in: Review task rationale (e.g., "Just a reminder that this drill [smartphone app] will help with your attention [or skill], which you mentioned would be useful.")

Table 7, continued

Key engagement targets	Clinician-driven engagement practices
	(b) <u>Performance Affirmation</u>: Provide specific and encouraging feedback pertinent to task completion (e.g., "You look like you are really concentrating."; "That was a high score on that drill.")
Self-Efficacy	(a) <u>Task Strategy</u>: Educate and encourage selection of performance enhancing behaviors (e.g., "Can you think of anything you can try that would make the task easier?"; "Would you like to hear some tips about what others have tried to increase their scores?") (b) <u>Task Choices</u>: Provide choices regarding task execution (e.g., "Would you prefer to take a break now or after the next task?") (c) <u>Task Prediction</u>: Provide an opportunity to predict performance or required effort (e.g., "On a scale of 1-5, how challenging do you think this task will be?") (d) <u>Task Reflection</u>: Provide opportunity to reflect on task performance (e.g., "How did that feel?"; "Is there anything you want to do differently?")
Therapeutic Alliance	(a) <u>Bonding Statement</u>: Inquire about personal status (e.g., "How was your morning?"; "Tell me about your week?") (b) <u>Active Listening Statement</u>: Ask about a topic or event mentioned in previous session (e.g., "How did your visit with your daughter go?"; "I remember you preferred to have the screen dimmed a bit…is this ok?") (c) <u>Positive Regard Statement</u>: Express authentic positive regard about an observation (e.g., "I'm impressed with your resilience when faced with challenges from your injury.")

The current dissertation intends to build on the findings from the pilot study in several ways. First, an additional dependent variable was added so that the potential effects of layering on engagement will be evaluated on attention drills and the learning of a smartphone app. Fidelity of implementation was also measured to enhance validity. The dissertation seeks to improve and strengthen measurement by increasing the frequency of measures across conditions and incorporating measures of motivation, self-efficacy, and therapeutic alliance that have shown increased sensitivity to affective states and therapeutic relational factors. Analysis was enhanced via the inclusion of effect size calculations and incorporation of qualitative data collected through participant commentary to compare with quantitative findings of affective and relational perceptions.

Rationale for the Present Study

The objective of this dissertation is to conduct exploratory research to evaluate the potential impact of clinician delivered clinical behaviors designed to enhance engagement on cognitive rehabilitation tasks and outcomes in a brain injury population. Specifically, the proposed study seeks to evaluate whether evidence-backed engagement practices designed to enhance therapeutic alliance, motivation, and self-efficacy will result in improved clinical performance on (a) a series of attention-based cognitive drills, and (b) the learning of a phone app for individuals with chronic cognitive deficits resulting from acquired brain injury. It is hypothesized that the introduction of engagement-enhancing clinical communication practices will positively impact client performance, including improved accuracy on the attention drills and learning the steps to use the phone app as well as adherence to home assignments. It is also hypothesized that when engagement-enhancing practices are delivered, clients will show perceptual shifts in therapeutic alliance and associated affective states. The results from this study will provide preliminary support in how clinical engagement practices can serve as critical ingredients to enhance rehabilitation outcomes.

Research Questions

The primary research question for the dissertation study is as follows:

RQ1: Is there a functional relation between the delivery of clinician-driven engagement practices and improved performance on cognitive drills targeting attention for individuals with chronic cognitive deficits following ABI?

Secondary questions for the dissertation study are as follows:

SQ1: Do participants show improved performance on a secondary cognitive task and retain more steps for using an external cognitive aid when the clinician applies engagement strategies during instruction?

SQ2: Do participants report increased perceptions of therapeutic alliance when clinicians add targeted engagement practices to their therapy?

SQ3: Do participants report increased perceptions of motivation when clinicians add targeted engagement practices to their therapy?

SQ4: Do participants report increased perceptions of self-efficacy when clinicians add targeted engagement practices to their therapy?

SQ5: Do participants exhibit greater adherence following exposure to clinician-directed engagement practices targeting motivation and self-efficacy?

CHAPTER III

Methods

Chapter III details the methods utilized in the dissertation study. The first section describes the setting and participant characteristics. The second section provides an overview of the single-case experimental design (SCED). The third section reviews the study procedures. The fourth section describes the study measures. The chapter concludes with a description of the various analysis processes and procedures.

Setting and Participant Characteristics

Due to the ongoing COVID-19 health crisis and the principal investigator's relocation out-of-state, data collection occurred remotely via secure telehealth sessions over the Zoom video teleconference platform. The version of the Zoom platform utilized for the study is HIPPA compliant and approved for telehealth. All sessions were recorded and securely stored for the purpose of analysis. Participants participated in the study while in their home environments utilizing personal electronic devices to access study components. All questionnaires and surveys were administered and completed via Qualtrics (https://www.qualtrics.com).

Participants

Four eligible participants with chronic cognitive deficits resulting from an acquired brain injury, notably in the cognitive domain of attention were recruited to participate in the study. Inclusionary and exclusionary criteria is described below, while Table 8 presents participant demographic characteristics.

Inclusionary criteria:

1. Aged 21 or older

2. English speaking, as study instruments have only been validated in English speaking individuals
3. Sustained an acquired brain injury that occurred over a year prior
4. Present with persistent moderate to severe attentional deficits as shown on a cognitive screener
5. Have the ability to follow both auditory and visual tasks/instructions
6. Access a computer, keyboard, smart phone, and sufficient internet access during their assigned sessions to participate in the study

Exclusionary criteria:

1. Participants cannot have any residual or pre-existing language deficits

Table 8

Demographic and Clinical Characteristics of Participants

Participant	Age	Sex	Race	Injury	Date of Injury	Severity	Previous Rehabilitation Enrollment	Currently Receiving Services
Stephanie	65	F	Caucasian	TBI/ CVA	2020	Moderate-Severe	Yes	No
Madeleine	21	F	Caucasian	TBI	2021	Severe	Yes	No
James	33	M	Caucasian/ Hawaiian	TBI	2017	Severe	Yes	Yes
Tiffany	48	F	Indian/ Asian	TBI	2020	Moderate-Severe	Yes	No

Recruitment was completed via online message boards/forums and emails, utilizing an Institutional Review Board (IRB) approved flyer, which was posted directly on message boards/forums or sent via email. The flyer included a brief description of the study, inclusion/exclusion criteria, information regarding compensation ($200.00) and a research assistant's contact information. The research assistant implemented an IRB-approved phone script and the cognitive screener (described below) to determine initial eligibility prior to scheduling an intake session to obtain consent and administer an auditory attention assessment to determine inclusion. All participants resided in either California or Virginia, which serve as states in which the principal investigator is licensed to deliver teletherapy.

Experimental Design

The dissertation study uses a SCED, specifically a concurrent multiple-baseline (MBL) design that includes both visual and quantitative analyses. While randomized control trial (RCT) designs are viewed as the gold-standard of experimental research design, SCEDs provide opportunities to apply foundational research utilizing real-world settings that can inform and enhance the implementation of larger scale designs, such as RCTs (Horner et al., 2005; Byiers et al., 2012). In the past decade, SCED has introduced a series of standards to enhance SCED methodologies and analysis, including the addition of statistical analyses to obtain effect size calculations to ensure that SCEDs are increasingly rigerous (Kratochwill et al., 2013; Evans et al., 2014). Additionally, SCED has begun to adopt elements from qualitative and mixed methods design approaches and analyses (Onghena et al., 2019), which will inform future analysis of the collected dissertation data.

In a SCED, experimental control of an independent variable is shown when demonstrations of an effect are observed across a minimum of three participants at a minimum of three different points in time (Byiers et al., 2012; Horner et al., 2005). Examination into various SCED designs revealed that a MBL design would be an effective design for the study. MBL designs not only allow for researchers to assess the impact of an independent variable across multiple participants, but eliminate the need for a withdrawal condition (Kratochwill et al., 2013). While withdrawal conditions add to the strength of a study’s internal validity (Byiers et al., 2012), it would be unrealistic to implement a withdrawal of the current independent variable, as we would anticipate the possibility of lingering effects following exposure to the independent variable. To strengthen internal validity and ensure adequate experimental control while implementing a concurrent MBL design, randomization has been embeeded into study procedures. Duration in baseline prior to exposure to the independent variable was staggered and randomly assigned to participants. The addition of randomization bolsters internal validity and the validity of statistical conclusions (Kratochwill & Levin, 2010).

Procedures

The study consisted of a phone screening and initial intake session, which were followed by a baseline and experimental phase. Each phase is described in detail below. Following the descriptions, a visual summary of procedures is outlined in Figure 4.

Phone Screening

Prior to the initial intake session, participants underwent a scripted phone screening led by a research assistant. Research assistants were utilized to alleviate the possibility of treatment effects resulting from interactions that might carry over into the study if the screening were to be conducted by the principal investigator. The purpose of the phone screening was to provide a brief description of the study, determine participant interest, and establish preliminary eligibility to determine if the individual meets inclusionary criteria to participate in the study. The phone screening included participation in the Telephone Interview for Cognitive Status (TICS). A description of the TICS is detailed below in the measurements section. A total of 25 individuals participated in the phone screening.

Initial Intake

Research assistants conducted the initial intake session. The initial intake session was dedicated to obtaining consent, HIPPA authorization, and collecting both personal and clinical information via a participant interview (e.g., sex, age, race, education, employment, date of injury, type of injury, injury severity, identified cognitive challenges and area(s) of concern post-injury). Participants also participated in the Conners Continuous Auditory Test of Attention (Conners CATA) to ensure attentional severity meets inclusionary criteria. A description of the measure is detailed below in the measurements section. All subsequent treatment sessions were led by the principal investigator.

Baseline Phase

The baseline phase consisted of four to ten sessions, with sessions occurring on separate days. Sessions took place across a one-to-two-week period and ranged from approximately 17-40-minutes in length. The intention was to allow for sufficient demonstrations of a stable range of performance on a series of cognitive attention drills to compare performance in baseline with performance in the experimental phase. An additional cognitive rehabilitation task, learning to use a phone application, was administered on the fourth baseline session for each participant. While performance stability generally serves as the primary measure to determine entry into the experimental phase in SCED (Horner et al., 2005), participants were randomly assigned to entry into the experimental phase to incorporate randomization to strengthen the study design, with predesignated entry occurring on sessions 4, 6, 8, 10. If a participant had not demonstrated a stable baseline based on their randomly assigned entry into the experimental phase, then the participant proceeded to the experimental phase and performance was examined for significant change, such as the onset of stability.

To minimize the accidental introduction of engagement behaviors (the independent variable), in the baseline condition, the principal investigator only engaged in basic greetings, scripted activity instructions, and simplistic explanations of homework assignments. Heavily scripted introductions and activity instructions served as the primary form of communication between the clinician and participant throughout baseline.

To quantify perceptions of motivation and self-efficacy across each session the principal investigator collected data via an affective state scale. The first and final clinical session of both the baseline phase concluded with the administration of the modified Working Alliance Inventory (WAI). Adherence was measured via completion of homework assignments provided at the conclusion of each session. Descriptions of the clinical tasks and assessment measures can be found below in the measurements section.

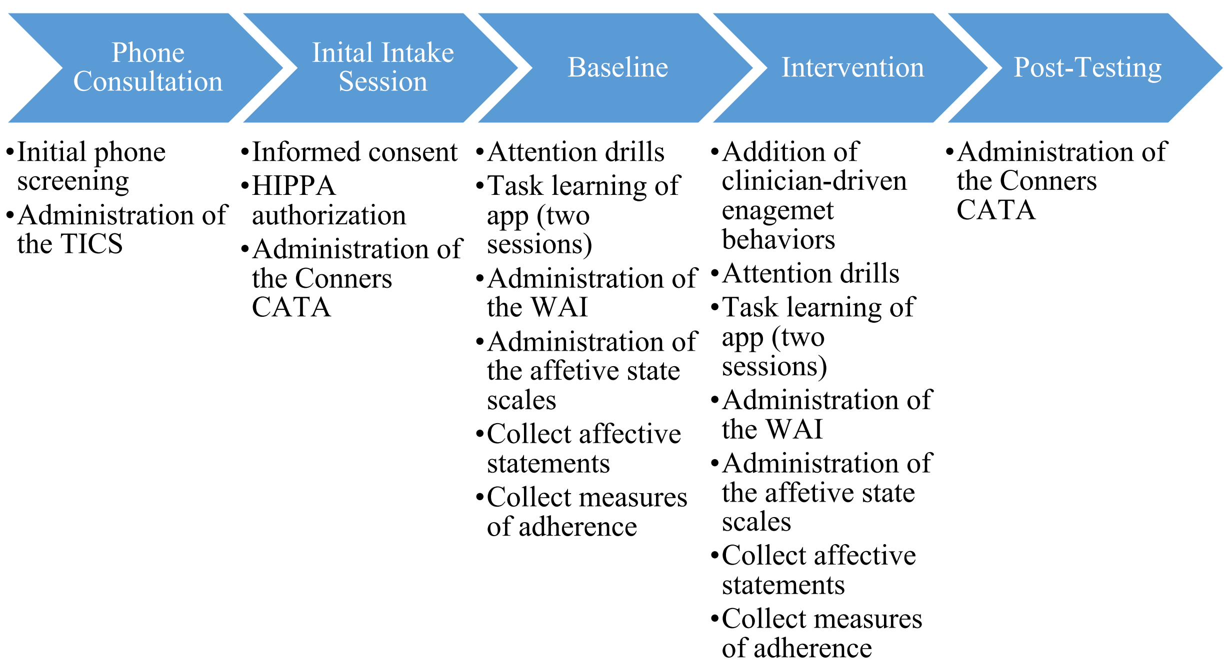
Experimental Phase

The experimental phase consisted of five to eleven sessions (11, 9, 7, or 5 experimental sessions), for a total of 15 sessions for each participant across both conditions. Sessions occurred on separate days across a one-to-two-week period, with sessions ranging from approximately 37-120-minutes in length. An additional cognitive rehabilitation task, learning to use a phone application, as administered on the fourth experimental session for each participant. The session structure mirrored the baseline phase, including the use of scripted instructions; however, each participant was exposed to the identified engagement practices delivered by the principal investigator. As described in Chapter II, and listed in Table 3 of that chapter, selected engagement practices have been shown to increase motivation, self-efficacy, and therapeutic alliance.

Similar to the baseline phase, to quantify perceptions of motivation and self-efficacy, the principal investigator collected data via an affective state scale. The first and final clinical session of the experimental phase concluded with the completion of the modified WAI. Adherence was be measured via homework assignment completion, with assignments provided at the conclusion of each session. At the conclusion of the experimental phase, each participant met with a research assistant to complete the Conners CATA to collect a pre-post outcome measure.

Figure 4

*Sequence of Procedure*s



Measurements

The measurements for the dissertation research are organized into three primary categories: inclusionary measures, repeated measures, and post hoc measures. Table 9 provides a summary of measures, including their applications within the study. Detailed descriptions of each measure are found below the table.

Table 9

Study Measurements

Measurement	Administration	Estimated Duration
TICS	Initial phone consultation	10-minutes
Conners CATA	Initial consultation in baseline phase and post-assessment	15-minutes
Attention drills	Every session in baseline and treatment phase	50-minutes
Task learning	Fourth session in the baseline and treatment phases	10-minutes
WAI	First and final session of the baseline and intervention phases	10-minutes
Affective state scales	Every session in baseline and treatment phase	2-minutes
Adherence	Every session in baseline and treatment phase	2-minutes

Inclusionary Measures

Screening measure. Telephone Interview for Cognitive Status (TICS) – The TICS (Brandt et al, 1988) is a 22-item global mental status test that can either be administered over the telephone or face-to face. The TICS demonstrates a high correlation with the Mini-Mental State Examination (MMSE) and has been found to have excellent sensitivity (94%) and specificity (100%) in differentiating participants. The TICS was administered during the initial phone screening and qualifying participants initially needed a score of 28 or below to participate in the initial intake session. However, the established qualifying score was deemed to be overly restrictive; therefore, the minimum score for participation in the initial intake session was adjusted to 32.

Inclusionary measure. Conners Continuous Auditory Test of Attention (Conners CATA) – Conners CATA (Conners, 2014) assesses problems in individuals aged eight years and older in areas of auditory inattentiveness, impulsivity, sustained attention, and vigilance. Stimuli consists of a series of N-back tasks targeting auditory attention and working memory skills. The Conners CATA is a computer-based assessment that was administered over Zoom utilizing the screenshare and remote-control features to allow for participants to access the stimuli and make real-time selections via their own keyboard. Participants needed to demonstrate scores in the high to very high classifications, indicating a strong likelihood of disordered attentional functioning, to be included in the study.

Repeated Measurements

Attention drills. Drills were used from the Attention Process Training, 3rd Edition (APT-3) program that contains exercises targeting specific domains of attention commonly disrupted after an acquired brain injury, such as working memory systems. The APT-3 was designed as an attention intervention program for people with brain injury and is intended to be paired with personalized metacognitive strategy instruction to effect attentional change (Lee, Sohlberg, Harn, Horner & Cherney, 2017). For the purposes of the current research study, each participant received training in the same metacognitive strategy approach. The purpose of the auditory attention drills paired with a metacognitive strategy was to provide ecological tasks that are commonly used in rehabilitation to allow evaluation of the impact of clinician administered engagement practices (Sohlberg, Turkstra, & Hamilton, 2022). After the completion of each session, the principal investigator extracted the attention drill responses for the purpose of data analysis.

There were two types of attention tasks, a *digit span task* and *word span task*, each was organized in a multi-level hierarchy requiring the participant to hold onto increasingly longer strings of information. The drills were administered similarly to the protocol described in the commercial APT program (Lash, 2010), from which they were been adapted. Span length serves as the terminal metric for the attention drill tasks and MBL analysis. There are five attention drills that required participants to manipulate the string of information presented at each level of the digit span hierarchy: putting the presented digits in (1) reverse order, (2) ascending order, (3) descending order, (4) adding three to the original order, and (5) subtracting two from the original order. There are three attention drills that required participants to manipulate the string of information presented at each level of the word span hierarchy: putting the words in (1) reverse order, (2) alphabetical order, and (3) progressive order. Each session, attention tasks began at the first level in the hierarchy (i.e., 3-digit spans or 4-word spans). The participant needed to complete all corresponding attention drills to move up to the next level in the hierarchy (i.e., 4-digit spans or 5-word spans). The drills were cycled through in the order shown in the Table 10, starting with digit sequences. When a participant demonstrated four consecutive correct responses, the drill was discontinued, and the clinician then presented the instructions for the next set of drills. When a participant demonstrated three consecutive errored responses, the digit span task was discontinued, and the principal investigator moved on to the word span sequences. Once a participant demonstrated three consecutive errored responses on the word span sequences, the session concluded. The tasks utilized different stimuli each session to avoid memorization of the stimuli.

Table 10

Sample APT-3 Attention Task Hierarchies

Attention task	Hierarchy	Attention drills
Digit span sequences	3-number sequences	Reverse Ascending Descending Add 3 Subtract 2
	4-number sequences	Reverse Ascending Descending Add 3 Subtract 2
Word-span sequences	4-word sentences	Reverse Alphabetical Progressive
	5-word sentences	Reverse Alphabetical Progressive

Working Alliance Inventory (WAI). The WAI is a self-reported 36-item Likert scale questionnaire that produces a composite score based on three key aspects of therapeutic alliance: (a) agreement on the tasks of therapy, (b) agreement on the goals of therapy and (c) development of an affective bond (Hovarth, 1994). The WAI was adapted to focus solely on questions related to establishment of an affective bond (see Appendix C), as tasks were preselected and specified goals were not established. The modified WAI was completed by each participant and consisted of 12 statements related to perceptions of bond between the participant and principal investigator. Statements were classified as nine positive and three negative statements, measured via a seven-point Likert scale. The survey was administered at four points across the study for each participant: (1) at the conclusion of their initial baseline session, (2) the conclusion of their final baseline session, (3) the conclusion of their initial experimental session, and (4) at the conclusion of their final experimental session. Survey statements were entered into and delivered via Qualtrics (https://www.qualtrics.com) for participants to securely enter their ratings.

Affective state scales. Two affective state scales were developed to examine a participant's perceptions of motivation and self-efficacy at the conclusion of each session. The Likert scales, ranging from one-to-seven, were modeled after Readiness Rulers, developed to support motivational interviewing (Moyers et al., 2009). Perceptions of motivation and self-efficacy were measured at the conclusion of each session, for a total of 15 administrations across phases for every participant. Each survey consisted of a total of four statements targeting perceptions of session motivation (see appendix D) and self-efficacy (see appendix E). Statements targeting session motivation were as follows: (1) I felt motivated throughout the session, (2) I was able to persist when I found the activities to be challenging, (3) I gave my best effort throughout the session, and (4) the session activities are meaningful and important to me. Statements targeting session self-efficacy were as follows: (1) doing well is important to me, (2) I felt capable of successfully completing session activities, (3) I could have tried harder, and (4) I am concerned about my performance on the session activities. While all motivation statements were classified as positive, self-efficacy statements were classified as two positive and two negative statements, which were differentiated for analytical purposes. Each scale was uploaded into Qualtrics (https://www.qualtrics.com) for participants to securely enter their ratings.

Spontaneous Statements. Sessions were recorded and relevant quotes were transcribed by research assistants to collect statements made by participants across each session. Qualitative analysis will be conducted separate from the dissertation study due to time constraints. Statements will be analyzed to identify themes related to motivation, self-efficacy, and perceptions of alliance. Findings from each condition will be compared to identify subjective changes across conditions and used to compare statements with findings from the WAI and affective scales.

Treatment adherence measures. Adherence was measured by tracking the rate of completion of a designated home exercise program (HEP). The HEP consisted of a series of pre-selected, attention-based digital exercises issued to the participants at the conclusion of each session through an online cognitive training program, HappyNeuron Pro (https://www.scientificbraintrainingpro.com). Each participant was provided with their own unique log-in to the program and assigned the same HEP based on the session number. Expectations were made clear that the exercise was to be completed by the next scheduled session. The intention of measuring homework adherence was to track participant motivation outside of the clinical sessions to determine if engagement practices would influence homework adherence. For the current research, HEP performance accuracy was not measured, solely tracking of completion rates. Performance was measured as either (a) completed or (b) not attempted.

Measurement of Task Learning

The study sought to probe the potential impact of clinician engagement practices on a second rehabilitation intervention. Training in assistive technology and external aids is a common approach embedded within neurorehabilitation (Sohlberg & Turkstra, 2011), and comprised a second rehabilitation activity. Two different smartphone applications targeting attentional and executive functioning skills were identified and equated for the number of steps (22-steps) and complexity: (a) Time Timer and (b) Focus Keeper (see Appendix B). The *Time Timer* application was introduced during the fourth session in the baseline phase. The *Focus Keeper* application was introduced during the fourth session of the experimental condition.

Instructional procedures were the same for both conditions. However, in the experimental condition, the engagement practices (see Table 3) were implemented. All application steps were modeled and described twice by the principal investigator and the participant was asked to demonstrate their recall of the steps. The clinician repeated the model and recorded the participant's subsequent performance during a final trial. The number of steps demonstrated accurately during the final trial were recorded for analysis and provided a comparison of learning in the baseline and experimental conditions. While there were not repeated measures, the comparison on two trials provided potential information on use of clinician-engagement practices on another type of cognitive rehabilitation activity.

Measurement of Treatment Implementation

Measurement of Treatment Fidelity. A fidelity checklist modified from the *Enhanced Medical Rehabilitation Adherence Rating Form (EMR-ARF) (Bland et al., 2016)* was utilized to ensure treatment fidelity. Bland et al. (2016) developed the EMR-ARF utilizing grounded behavior change theory to establish a protocol to address rehabilitation treatment adherence and engagement. The tool consists of 18 motivational techniques, elicited by a clinician, to increase patient effort and progress by linking motivation to established clinical goals. The current fidelity checklist modified the EMR-ARF by removing components tied to clinical goal attainment and adding the nine clinician-driven engagement practices along with the clinical processes. See Appendix A.

Fidelity was conducted by two research assistants, both of whom are second year graduate students enrolled in the University of Oregon's Master's in Communication Disorders and Sciences program. Training on fidelity occurred prior to the start of the study, which included a detailed review of the fidelity checklist and participation in a series of scoring trials, which were conducted until the research assistants were collectively able to establish a percentage of agreement greater than 90%. For the study, the percentage of inter-observer agreement (IOA) was collected and calculated on 25% of baseline sessions (seven sessions) and 25% of experimental phase sessions (eight sessions), as indicated by What Works Clearinghouse (Kratochwill et al., 2010). Sessions were blinded prior to analysis. The purpose of fidelity was to note the absence of clinician-driven engagement practices in the baseline condition and ensuring their presence in the experimental condition. A weighted Cohen's *Kappa* was calculated to assess the level of agreement between both observers on the application of clinician-directed engagement practices across digit and word-span tasks. Fidelity reviewers also tracked the number of instances each clinician-driven engagement practice was exhibited, to assist with determining the most feasibly applied and potent ingredients for future analysis. Additionally, the reviewers recorded key statements made by participants, namely statements related to affective states and perceptions of alliance, that will be used for eventual comparison with survey findings.

Analyses

Quantitative measures were used to answer the primary and secondary research questions. Analyses are separated below by the specific research question they are aimed at answering.

Primary Research Question: Is there a functional relation between the delivery of clinician-driven engagement practices and improved performance on cognitive drills targeting attention for individuals with chronic cognitive deficits following ABI?

The results of the repeated measurements on participant performance across cognitive drills was graphed to allow for comparison of data through visual analysis, consistent with the accepted standards of single-case research (Kratochwill et al., 2013). The purpose of visual analysis is to determine the presence of a functional relation between the independent and dependent variables based upon changes in trend, level, variability, and immediacy of effect within the data (Ledford & Gast, 2009). Visual analysis was supported by completing a non-overlap analysis of plotted data, specifically the use of a Tau-U calculation via the Tau-U Calculator (Brossart et al., 2018; Tarlow, 2017). An effect size calculation was derived from a design-comparable effect size (D-CES) calculation. The D-CES was developed for MBL designs to establish an effect size calculation comparable to the standardized mean difference from a between-subjects randomized experimental study (Pustejovsky et al., 2014).

Secondary Question 1: Do participants show improved performance on a secondary cognitive task and retain more steps for using an external cognitive aid when the clinician applies engagement strategies during instruction?

The results of participant performance across the application task learning was graphed to allow for visual comparison. Analytical comparisons were made between performance across conditions to determine whether there is preliminary support that the introduction of clinician-directed engagement practices could result in improved task learning performance.

Secondary Question 2: Do participants report increased perceptions of therapeutic alliance when clinicians add targeted engagement practices to their therapy?

As previously described, perceptions of therapeutic alliance were collected via the WAI. Scores were calculated by adding up total scores, including reversed items, which are scored inversely. While the WAI is a well-cited measure, it does not have standard scores for comparison due to individual differences and contextual variables among scorers (Hovarth, 1994). Scores were averaged to develop a mean composite score for comparison between conditions (Busseri & Tyler, 2003). The results of participant performance across administrations of the modified WAI were graphed to allow for visual comparison. Due to the limited number of administrations across the study, WAI data could not be plotted in a MBL format for visual analysis or effect size calculation, as the number of observations does not meet the criteria for SCED standards (Kratochwill, 2010; Horner, 2005).

Secondary Question 3: Do participants report increased perceptions of motivation when clinicians add targeted engagement practices to their therapy?

As previously described, perceptions of motivation were collected via Likert scales. A mean composite score was calculated at the conclusion of every session based on each participant's responses. Composite scores were graphed to allow for comparison of data through visual analysis, consistent with the accepted standards of single-case research (Kratochwill et al., 2013). Visual analysis was supported by completing a non-overlap analysis of plotted data to obtain a Tau-U score via the Tau-U Calculator (Brossart et al., 2018; Tarlow, 2017). An effect size calculation was derived from a D-CES calculation (Pustejovsky et al., 2014).

Secondary Question 4: Do participants report increased perceptions of self-efficacy when clinicians add targeted engagement practices to their therapy?

As previously described, perceptions of self-efficacy were collected via Likert scales. A mean composite score was calculated at the conclusion of every session based on each participant's responses. Composite scores were graphed to allow for comparison of data through visual analysis, consistent with the accepted standards of single-case research (Kratochwill et al., 2013). Visual analysis was supported by completing a non-overlap analysis of plotted data to obtain a Tau-U score via the Tau-U Calculator (Brossart et al., 2018; Tarlow, 2017). An effect size calculation was derived from a D-CES calculation (Pustejovsky et al., 2014).

Secondary Question 5: Do participants exhibit greater homework adherence following exposure to clinician-directed engagement practices targeting motivation and self-efficacy?

Homework completion rates were tracked for each participant across every session. Composite scores were graphed to allow for comparison of data through visual analysis, consistent with the accepted standards of single-case research (Kratochwill et al., 2013). Visual analysis was supported by completing a non-overlap analysis of plotted data to obtain a Tau-U score via the Tau-U Calculator (Brossart et al., 2018; Tarlow, 2017). An effect size calculation was derived from a D-CES calculation (Pustejovsky et al., 2014).

CHAPTER IV

Results

The following chapter details (a) the results of the study organized according to the research questions, (b) treatment fidelity, (c) pre and post outcome data, and (d) ratios of correct versus errored responses across conditions.

Primary Research Question: Is there a functional relation between the delivery of clinician-driven engagement practices and improved performance on cognitive drills targeting attention for individuals with chronic cognitive deficits following ABI?

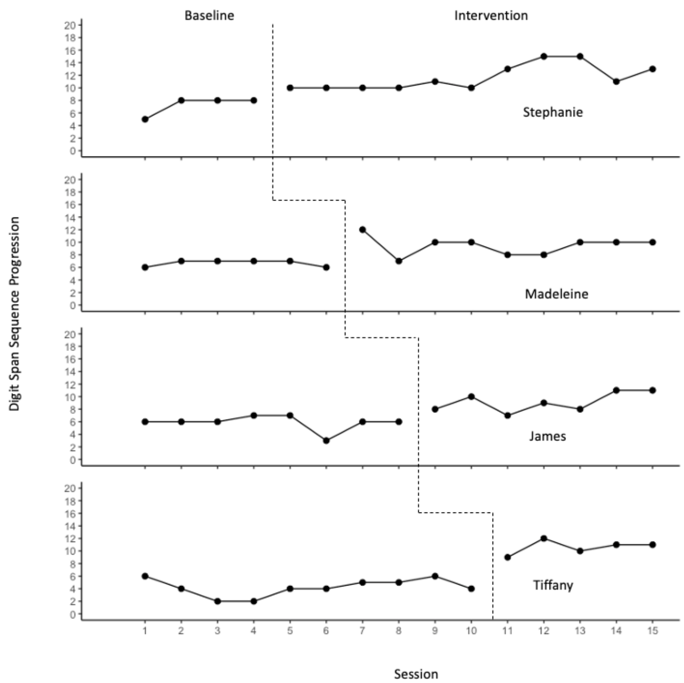
For the primary research question, it was hypothesized that the introduction of clinician-directed engagement practices would result in improved performance on a series of cognitive drills. The data displayed in Figures 5 (digit span) and 6 (word span) provide the plotted results utilized for visual analysis. Prior to analysis, it was hypothesized that changes in level, trend, and immediacy of effect would be sensitive to identifying a functional relation, while variability and overlap were likely to lack stability due to randomization of entry into the experimental phase.

Digit Span Analysis

Digit Span Visual Analysis. Performance data were graphed to facilitate visual analysis of length of correct digit span stimulus strings between both phases for each individual participant (Horner et al., 2005). Observations were made regarding changes in level, trend, variability, immediacy of effect, and overlap between conditions. Plotted data of digit span performance utilized for visual analysis is displayed in Figure 5.

Figure 5

Digit Span Sequence Progression Based on Correct Responses



Examination into the visual analysis of plotted data supports the existence of a functional relation between the delivery of clinician-driven engagement practices and improved performance on a series of digit span cognitive drills. Baseline stability was noted across all participants, particularly among Stephanie and James. While stability was fairly consistent for Madeleine and Tiffany, they both exhibited a sudden downward trend prior to entry into the experimental phase. Of note, both James and Tiffany exhibited the greatest amount of variability among the participants throughout the baseline phase; however, this was anticipated, as they spent the greatest amount of time in the baseline phase.

Transition into the experimental phase resulted in a level change among each participant, indicating an immediacy of effect. Both Madeleine and Tiffany exhibited the most significant change in level; however, following the immediate change in condition, Madeleine demonstrated a sudden decline in performance in session eight, which was followed by a gradual increase in trend and eventual stability across subsequent sessions. Stephanie, James, and Tiffany demonstrated fairly stable positive trends with gradual increases across the experimental phase. The rate of positive trends increases significantly in the experimental phase, as compared with trend rates in the baseline phase. While minimal variability was noted among each participant throughout the experimental phase, variability resulted in minimal overlap with baseline performance for two participants. Both Madeleine and James had a single instance in which their performance during the experimental phase declined to the level of their peak performance during the baseline phase. The study concluded with stable performance across three participants, while Stephanie concluded on an upward trend. Collectively, visual analysis of digit span performance reveals that each participant demonstrated sufficient evidence of effects across a minimum of three separate points in time, indicating a functional relation (Kratochwill, 2010; Horner, 2005). A summary of visual analysis of digit span findings is detailed in Table 11.

Table 11

Summary of Digit Span Visual Analysis

Participant	Level change		Increasing trend		Variability		Immediacy of effect		Overlap	
	BL	TX	BL	TX	BL	TX	BL	TX	BL	TX
Stephanie	N/A	Yes	No	Yes	No	Yes	N/A	Yes	No	No
Madeleine	N/A	Yes	No	Yes	No	No	N/A	Yes	No	No
James	N/A	Yes	No	Yes	No	Yes	N/A	Yes	No	No
Tiffany	N/A	Yes	No	Yes	Yes	No	N/A	Yes	No	No

Note. BL = baseline phase; TX = treatment phase

Digit Span Tau-U Analysis. Visual analysis of digit span performance was supported via quantitative analysis to identify statistical differences between the baseline and experimental phases. The first quantitative calculation utilized was *Tau-U*, which provides an effect size estimate of nonoverlap between phases, while controlling for monotonic trends. The *Tau-U* was calculated using a publicly available online calculator. Parker et al. (2011) provides the framework utilized for interpreting *Tau-U* scores: .65 or lower: *weak to small effect*; .66 to .92: *medium to high effect;* and .93 to1: *large or strong effect*. The findings show that Stephanie (1.00), James (.964), and Tiffany (1.00) had a *strong* treatment effect among each individual participant on digit span tasks, while Madeleine (.926) demonstrated *medium to hig*h treatment effect. Collectively, the participants yielded an overall weighted *Tau-U* average of .972, indicating a strong treatment effect. The *Tau-U* scores support visual analysis of digit span findings. *Tau-U* digit span results can be found in Table 12.

Table 12

Tau-U Digit Span Results

Participant	Tau-U Score
Stephanie	1.00
Madeleine	.926
James	.964
Tiffany	1.00
Combined Participant Score	.972

Note. The Single Case Research free calculator (http://www.singlecaseresearch.org/) was utilized to calculate the *Tau-U* effect size values. Baseline trend correction not required.

Digit Span D-CES Analysis. In an effort to further augment visual analysis of digit span performance, D-CES provided an additional effect size calculation in which data is averaged across participants to estimate an across-participant average effect for MBL designs (Kratochwill et al., 2021). Pustejovsky et al. (2016) developed an online web application, which was utilized to calculate D-CES for the current study. Cohen (1988) provides the framework utilized for interpreting D-CES estimates: *d* = 0.2 or lower: *small effect*; *d* = 0.5: *medium effect;* and *d* = 0.8: *large effect*. The participants yielded an overall weighted score of 2.274, indicating a *large* treatment effect. Additionally, D-CES provided a standard error score of .466 and an autocorrelation estimate of .437. The D-CES scores support digit span visual analysis findings. D-CES digit span results can be found in Table 13.

Table 13

D-CES Digit Span Results

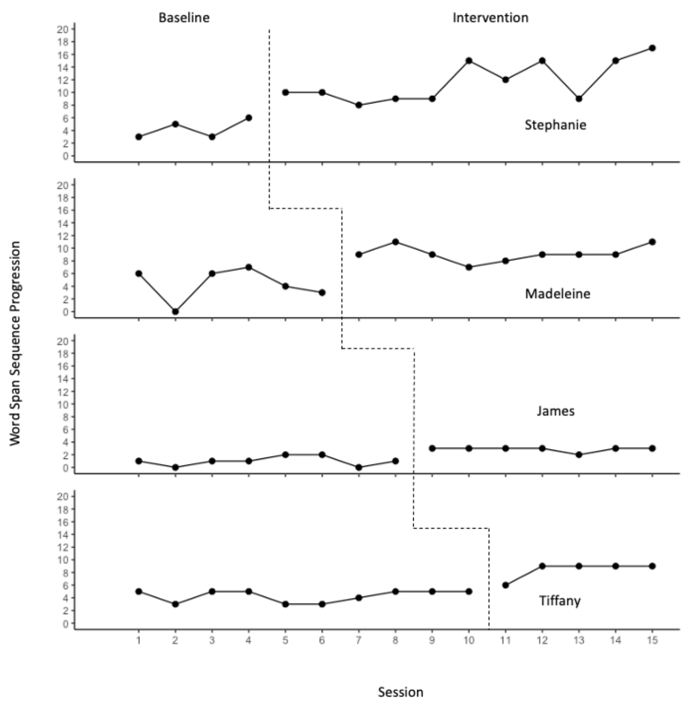
D-CES Estimate	Standard Error	Autocorrelation Estimate
2.274	.466	.437

Word Span Analysis

Word Span Visual Analysis. Performance data was graphed to facilitate visual analysis of length of correct word span stimulus strings between both phases for each individual participant (Horner et al., 2005). Observations were made regarding changes in level, trend, variability, immediacy of effect, and overlap. Plotted data of word span performance utilized for visual analysis is displayed in Figure 6.

Figure 6

Word Span Sequence Progression Based on Correct Responses



Visual inspection of word span data supports the existence of a functional relation between the delivery of clinician-driven engagement practices and improved performance on a series of word span cognitive drills. Baseline performance on word span tasks had greater volatility for Stephanie and Madeleine, particularly as compared with their performance stability on digit span tasks. Conversely, James and Tiffany exhibited fairly stable baseline performance as compared with their performance on digit span tasks, despite being in baseline for a greater number of sessions. It should be noted that both Stephanie and James were on an upward trend when they entered the experimental phase, while Tiffany demonstrated performance stability and Madeleine was on a slight downward trend.

Upon entering the experimental phase, each participant demonstrated an immediate change in level. While James and Tiffany demonstrated small level change improvements, Stephanie and Madeleine exhibited more significant level gains. However, similar to digit span tasks, Madeleine demonstrated a decline in performance following entry into the experimental phase, but then exhibited consistent improvement trends beginning session eleven. Stephanie demonstrated the greatest amount of variability, as was expected due to their extensive time in the experimental phase. Despite performance variability, Stephanie's performance did not result in overlap with baseline performance. Madeleine, James, and Tiffany exhibited fairly stable performance trends throughout the experimental phase. However, similar to the digit span task, both Madeleine and James had instances in which their performance during the experimental phase dropped to the level of their peak performance during the baseline phase. The study concluded with stable performance trends among three participants, while Stephanie concluded on an upward trend. Visual analysis of word span performance supports that each participant demonstrated sufficient evidence of effects across a minimum of three separate points in time, indicating a functional relation (Kratochwill, 2010; Horner, 2005). A summary of visual analysis of word span findings is detailed in Table 14.

Table 14

Summary of Word Span Visual Analysis

Participant	Level change		Increasing trend		Variability		Immediacy of effect		Overlap	
	BL	TX	BL	TX	BL	TX	BL	TX	BL	TX
Stephanie	N/A	Yes	Yes	Yes	Yes	Yes	N/A	Yes	No	No
Madeleine	N/A	Yes	No	Yes	Yes	No	N/A	Yes	No	No
James	N/A	Yes	Yes	No	No	No	N/A	Yes	No	No
Tiffany	N/A	Yes	No	No	No	No	N/A	Yes	No	No

Note. BL = baseline phase; TX = treatment phase

Word Span Tau-U Analysis. Visual analysis of word span performance was supported via quantitative analysis to identify statistical differences between the baseline and experimental phases. The first quantitative calculation utilized was *Tau-U*, which provides an effect size estimate of nonoverlap between phases, while controlling for monotonic trends. The *Tau-U* was calculated using a publicly available online calculator. Parker et al. (2011) provides the framework utilized for interpreting *Tau-U* scores: .65 or lower: *weak to small effect*; .66 to .92: *medium to high effect;* and .93 to1: *large or strong effect*. The findings show that Stephanie (1.00), Madeleine (.982), James (.964), and Tiffany (1.00) all exhibited strong treatment effects on word span tasks. Collectively, the participants yielded an overall weighted score of .986, indicating a strong treatment effect. The *Tau-U* scores support visual analysis word span findings. *Tau-U* word span results can be found in Table 15.

Table 15

Tau-U Word Span Results

Participant	Tau-U Score
Stephanie	1.00
Madeleine	.982
James	.964
Tiffany	1.00
Combined Participant Score	.986

Note. The Single Case Research free calculator (http://www.singlecaseresearch.org/) was utilized to calculate the *Tau-U* effect size values. Baseline trend correction not required.

Word Span D-CES Analysis. In an effort to further augment visual analysis of word span performance, D-CES provided an additional effect size calculation in which data is averaged across participants to estimate an across-participant average effect for MBL designs (Kratochwill et al., 2021). Pustejovsky et al. (2016) developed an online web application, which was utilized to calculate D-CES for the current study. Cohen (1988) provides the framework utilized for interpreting D-CES estimates: *d* = 0.2: *small effect*; *d* = 0.5: *medium effect;* and *d* = 0.8: *large effect*. The participants yielded an overall weighted score of 1.076, indicating a *large* treatment effect. Additionally, D-CES provided a standard error score of .434 and an autocorrelation estimate of .384. The D-CES scores ultimately support word span visual analysis findings. D-CES word span results can be found in Table 16.

Table 16

D-CES Word Span Results

D-CES Estimate	Standard Error	Autocorrelation Estimate
1.076	.434	.384

Secondary Question 1: Do participants show improved performance on a secondary cognitive task and retain more steps for using an external cognitive aid when the clinician applies engagement strategies during instruction?

It was hypothesized that the introduction of clinician-directed engagement practices would result in improved performance on external aid task learning activities. As described in Chapter III, an additional cognitive task was introduced to determine proof of concept across an alternative cognitive rehabilitation task typically administered within rehabilitation contexts. Training was provided in the use of two phone applications designed to compensate for attentional and executive functioning deficits. Retention of the number of recalled steps for two equated apps, *Time Timer* and *Focus Keeper*, served as the measure for this activity. The *Time Timer* app was administered on the fourth session of the baseline condition, while the *Focus Keeper* app was administered on the fourth session of the experimental condition, to determine potential impact of the application of clinician-directed engagement practices. It was anticipated that the addition of clinician-directed engagement practices would result in improved task learning. The data displayed in Figure 7 provides the plotted results.

A mean composite score was calculated for each participant by averaging the number of steps each participant retained across two separate task administrations. During the initial trials, each participant was able to retain the first three-steps, 13.64% of possible steps, when asked to independently demonstrate the learned task sequence. Each participant demonstrated performance improvements between the first and second task applications, supporting the initial hypothesis. The results are as follows: Samantha improved by 31.81%, Madeleine by 9.09%, James by 9.09%, and Tiffany by 27.27%. Combined visual plots of participant performance can be found in Figure 7, while details of the percentage of improvement for each participant can be found in Table 17. Effect size calculations were not conducted, as data was only collected at two points in time for each participant. Although, very preliminary, analysis supports the hypothesis that the introduction of clinician-directed engagement practices resulted in improved task learning performance.

Figure 7

Percentage of Steps Recalled During an External Aid Learning Task

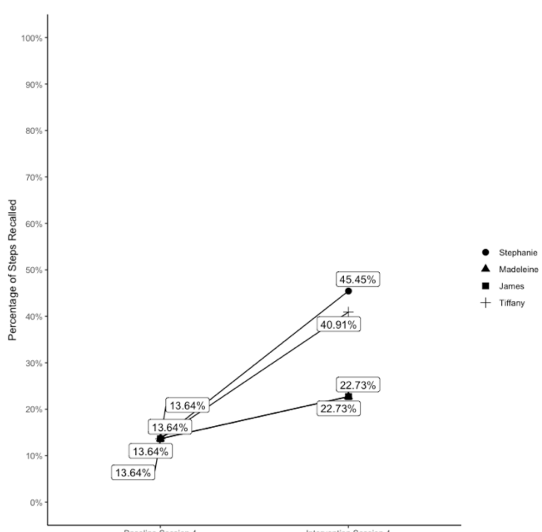


Table 17

Percentage of Improvement on Task Learning

Participant	Phase	Number of Steps Recalled	Percentage	Percentage of Improvement
Stephanie	Baseline Session 4	3 out of 22	13.64%	
Stephanie	Intervention Session 4	10 out of 22	45.45%	31.81%
Madeleine	Baseline Session 4	3 out of 22	13.64%	
Madeleine	Intervention Session 4	5 out of 22	22.73%	9.09%
James	Baseline Session 4	3 out of 22	13.64%	
James	Intervention Session 4	5 out of 22	22.73%	9.09%
Tiffany	Baseline Session 4	3 out of 22	13.64%	
Tiffany	Intervention Session 4	9 out of 22	40.91%	27.27%

Treatment Fidelity

As described in Chapter III, to evaluate the level of agreement between the two independent observers, a weighted Cohen's *Kappa* was calculated to assess the level of agreement between both observers on the application of clinician-directed engagement practices across a series of cognitive rehabilitation tasks. Two trained research assistants served as the independent observers for the study. A total of 25% of baseline sessions (seven sessions) and 25% of experimental sessions (eight sessions) were rated for fidelity. A fidelity checklist was developed to ensure the accurate *measurement of fidelity (see Appendix A).* Baseline sessions were rated to ensure the absence of clinician-directed engagement behaviors, while experimental sessions were rated to ensure the inclusion of clinician-directed engagement behaviors. Table 18 displays the average fidelity ratings for each participant based on mean calculations of reliability, the table includes an overall rating across all observed sessions. The *Kappa* results are also displayed in Table 18 and indicate acceptable treatment fidelity, $K = .861$, $p < .001$, 95% CI [.754, .968].

Table 18

Weighted Cohen's Kappa Results

Reviewer	Stephanie	Madeleine	James		Tiffany
1	1.67	1.71	1.54		1.53
2	1.69	1.69	1.61		1.60
	K	*p*	95% CI		
			LL	UL	
Value	.861	<.001	.754	.968	

Note. Weighted Cohen's *Kappa* calculated with quadratic weights.

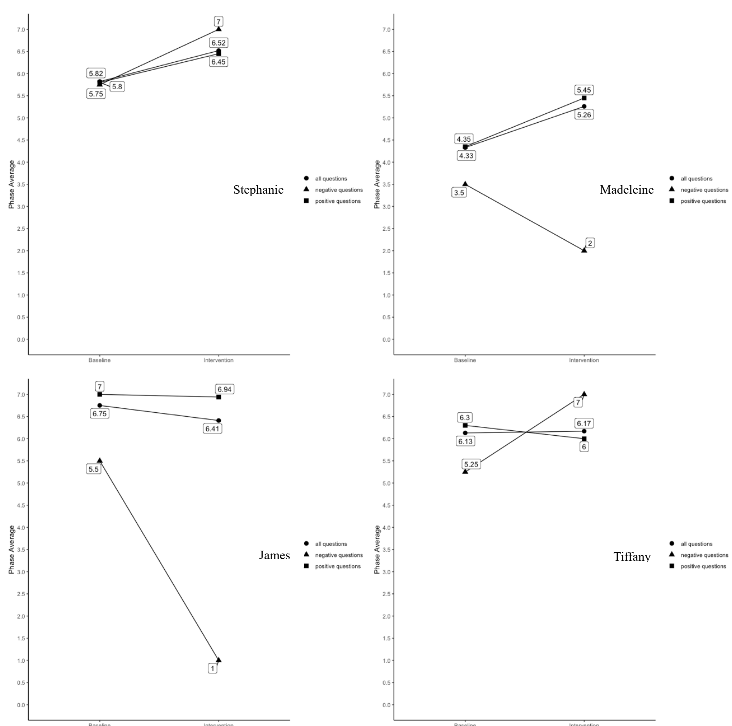
Secondary Question 2: Do participants report increased perceptions of therapeutic alliance when clinicians add targeted engagement practices to their therapy?

It was initially hypothesized that participants would experience increased perception of therapeutic alliance following the introduction of clinician-directed engagement practices. Therapeutic alliance was measured via survey responses of bond statements taken from the WAI. The modified WAI consisted of 12 statements, classified as nine positive and three negative statements, measured via a seven-point Likert scale. As described in Chapter III, the survey was administered at four points across the study for each participant: (1) at the conclusion of their initial baseline session, (2) the conclusion of their final baseline session, (3) the conclusion of their initial experimental session, and (4) at the conclusion of their final experimental session. Statements were divided, based on their classification (positive vs negative) and phase (baseline vs experimental), and scores for negative statements were inversed to reflect anticipated trends. Scores were averaged to procure a composite mean score for each phase. A combined mean composite score was also calculated. All calculations were plotted for visual analysis of survey responses. It was hypothesized that statements would result in an upward plotted trend. Upward trends indicate improved perceptions of alliance across phases. Due to limited administrations, an effect size was not calculated for the WAI statements.

Stephanie served as the only participant to follow expected and hypothesized respondent trends, in which all statements resulted in an upward trend. Both Madeleine and James exhibited upward trends for positive statements; however, they also demonstrated downward trends for negative statements across phases. Tiffany demonstrated a slight downward trend for positive statements, while also exhibiting an upward trend for negative statements. Based on combined averages, Stephanie, Madeleine, and Tiffany exhibited a slight upward trend, while James presents with a slight downward trend. While responses generally countered the initial hypothesis, selected qualitative responses confounded some of the quantitative findings, which will be used for future analysis. Plotted WAI survey results can be found in Figure 8.

Figure 8

WAI Responses for Each Participant



Secondary Question 3: Do participants report increased perceptions of motivation when clinicians add targeted engagement practices to their therapy?

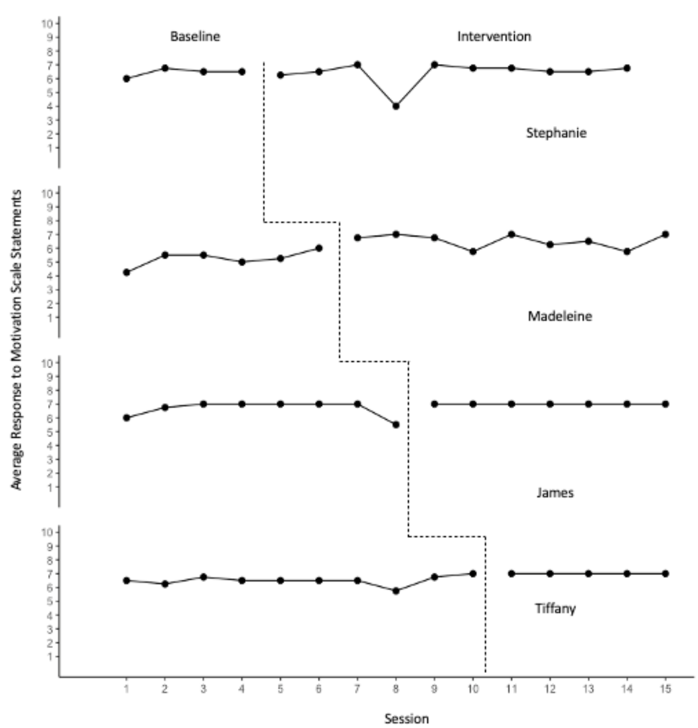
It was initially hypothesized that participants would experience increased perceptions of motivation following the introduction of clinician-directed engagement practices. As described in Chapter III, perceptions of motivation were measured via a survey administered at the conclusion of each session, for a total of 15 administrations across phases for each participant. The survey consisted of a total of four statements targeting perceptions of session motivation (see Appendix D), measured via a seven-point Likert scale. Scores from each session were averaged to develop a mean composite score for each session. Calculations were plotted for visual analysis of survey responses (see Figure 9). It was hypothesized that positive statements would result in an upward plotted trend, which is indicative of improved perceptions of motivation across phases. Since the survey was administered every session, *Tau-U* and D-CES effect size calculations were formulated to provide further support for visual analysis.

Analysis for Perceptions of Motivation

Visual Analysis. Based on visual analysis, Stephanie demonstrated fairly stable baseline performance, but did not demonstrate an immediacy of effect. She exhibited a gradual increasing trend in level, despite some trend variance, including a single instance of significant decline on session eight. Due to a lack of level change and trend stability, fairly significant overlap was observed between conditions. Madeleine demonstrated an upward trend in baseline prior to entering the experimental phase, which resulted in an immediacy of effect with an immediate change in level; however, response variability resulted in multiple instances of overlap between conditions. James demonstrated fairly stable baseline, with a slight decrease prior to entry into the experimental phase, which resulted in an immediacy of effect. However, upon entry into the experimental phase, James demonstrated a consistent level and trend without any variability or overlap. Tiffany exhibited a fairly stable baseline trend with gradual increases prior to entry into the experimental phase, at which point she exhibited consistent a level and trend without variability or overlap. Of note, both Stephanie and Madeleine concluded the study on an upward trend. Analysis does not fully support the hypothesis that the introduction of clinician-directed engagement practices resulted in improved perceptions of motivation; however, selected qualitative responses confounded some of the findings, which will be used for future analysis. Plotted data from the motivation surveys utilized for visual analysis is displayed in Figure 9.

Figure 9

Motivation Survey Responses for Each Participant



Quantitative Analysis. An overall weighted *Tau-U* score of .600, indicates a small treatment effect, while a weighted D-CES score of 0.746 indicates a medium treatment effect. D-CES also provided a standard error score of .266 and an autocorrelation estimate of .033. *Tau-U* results of perceptions of motivation can be found in Table 19, while D-CES results are detailed in Table 20. Based on comparisons between visual analysis and effect size calculations, the *Tau-U* score appears to support visual analysis of perceptions of motivation findings, while D-CES appears to inflate findings.

Table 19

Tau-U Motivation Survey Results

Value	Score
Tau-U	.600

Note. The Single Case Research free calculator (http://www.singlecaseresearch.org/) was utilized to calculate the *Tau-U* effect size values. Baseline trend correction required.

Table 20

D-CES Motivation Survey Results

D-CES Estimate	Standard Error	Autocorrelation Estimate
0.746	.266	.033

Secondary Question 4: Do participants report increased perceptions of self-efficacy when clinicians add targeted engagement practices to their therapy?

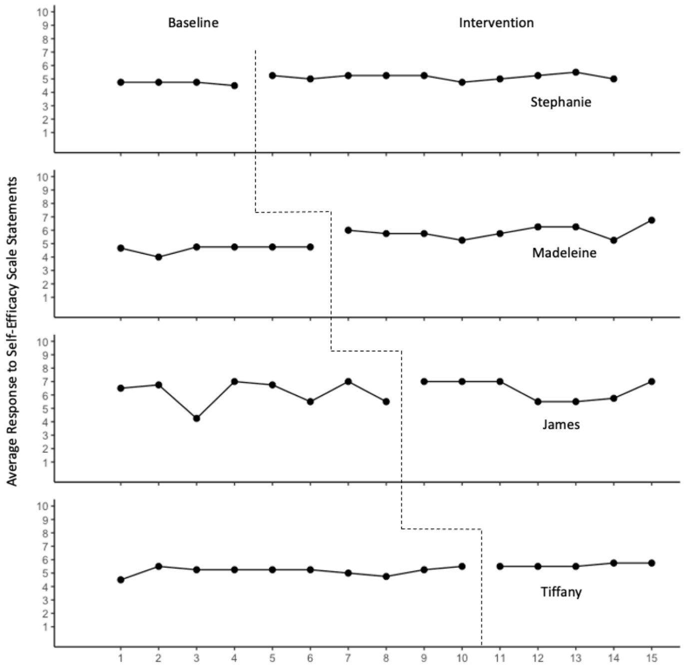
It was hypothesized that participants would experience increased perceptions of self-efficacy following the introduction of clinician-directed engagement practices. As described in Chapter III, perceptions of self-efficacy were measured via a survey administered at the conclusion of each session, for a total of 15 administrations across phases. The survey consisted of a total of four statements (see Appendix E), classified as two positive and two negative statements, measured via a seven-point Likert scale. Statements were divided, based on their classification (positive vs negative) and phase (baseline vs experimental), and scores for negative statements were inversed to reflect anticipated trends. Scores were averaged to procure a composite mean score for each phase. An overall mean composite score was also calculated. All calculations were plotted for visual analysis of survey responses. It was hypothesized that statements would result in an upward plotted trend. Upward trends indicate improved perceptions of self-efficacy across phases. Since the survey was administered every session, *Tau-U* and D-CES effect size calculations were formulated to provide further support for visual analysis.

Analysis of Self-Efficacy Statements

Visual Analysis. As noted above, statements were anticipated to show an upward plotted trend. Stephanie, Madeleine, and Tiffany exhibited a consistent level and trend throughout baseline, while James demonstrated baseline variability. Tiffany was the only participant to enter the experimental phase on an upward trend. Stephanie and James demonstrated a slight downward trend prior to entry into the experimental phase, while Madeleine maintained performance stability at entry. Stephanie, Madeleine, and James had a slight change in level upon entry into the experimental phase, indicating an immediacy of effect. Tiffany entered the experimental phase maintaining trend and level stability throughout, with a slight increase in trend for the final two sessions of the experimental phase. Stephanie, Madeleine, and James each exhibited mild variability throughout the experimental phase, which resulted in intermittent instances of overlap, particularly for James. Due to variability, both Madeleine and James concluded the study with an upward plotted trend, while Stephanie exhibited a slight downward trend. Analysis provides initial support the hypothesis that the introduction of clinician-directed engagement practices resulted in improved perceptions of self-efficacy. Plotted data from each participant's self-efficacy survey responses utilized for visual analysis is displayed in Figure 10.

Figure 10

Self-Efficacy Statement Survey Responses for Each Participant



Quantitative Analysis. An overall weighted *Tau-U* score of .7508, indicates a moderate treatment effect, which was supported by a weighted D-CES score of 0.701, indicating a moderate treatment effect. D-CES also provided a standard error score of .268 and an autocorrelation estimate of -0.003. *Tau-U* results of perceptions of self-efficacy can be found in Table 21, while D-CES results are detailed in Table 22. Based on comparisons between visual analysis and effect size calculations, both *Tau-U* and D-CES scores appear to support visual analysis of self-efficacy findings associated with positive statements.

Table 21

Tau-U Self-Efficacy Survey Results

Value	Score
Tau-U	.7508

Note. The Single Case Research free calculator (http://www.singlecaseresearch.org/) was utilized to calculate the *Tau-U* effect size values. Baseline trend correction required.

Table 22

D-CES Self-Efficacy Survey Results

D-CES Estimate	Standard Error	Autocorrelation Estimate
0.701	.268	-0.003

Secondary Question 5: Do participants exhibit greater homework adherence following exposure to clinician-directed engagement practices targeting motivation and self-efficacy?

It was hypothesized that participants would demonstrate improved adherence following the introduction of clinician-directed engagement practices. As described in Chapter III, homework completion served as the metric for determining adherence. Homework was assigned to each participant at the conclusion of each session and was anticipated to be completed by the start of their next session, for a total of 14 assignments for each participant. Assignment completion was tracked via the HappyNeuron Pro website (https://www.scientificbraintrainingpro.com).

A mean composite score was calculated for each participant by averaging the number of assignments completed in each phase. Throughout the baseline phase, both Stephanie and Madeleine completed 100% of assignments, while James completed 25% and Tiffany 70% of assignments. Across the experimental phase, Stephanie and Madeleine maintained their homework submission rate, while both James and Tiffany increased their submission rate to 100% across all remaining sessions. Result show that James improved by 75% and Tiffany by 30%. Increased homework performance supports the established hypothesis. Overall, homework completion was as follows: Stephanie (100%), Madeleine (100%), James (57%), and Tiffany (79%). Combined visual plots of participant homework performance can be found in Figure 11, while details of the percentage of improvement for each participant can be found in Table 23.

Figure 11

Homework Completion Rates for Each Participant

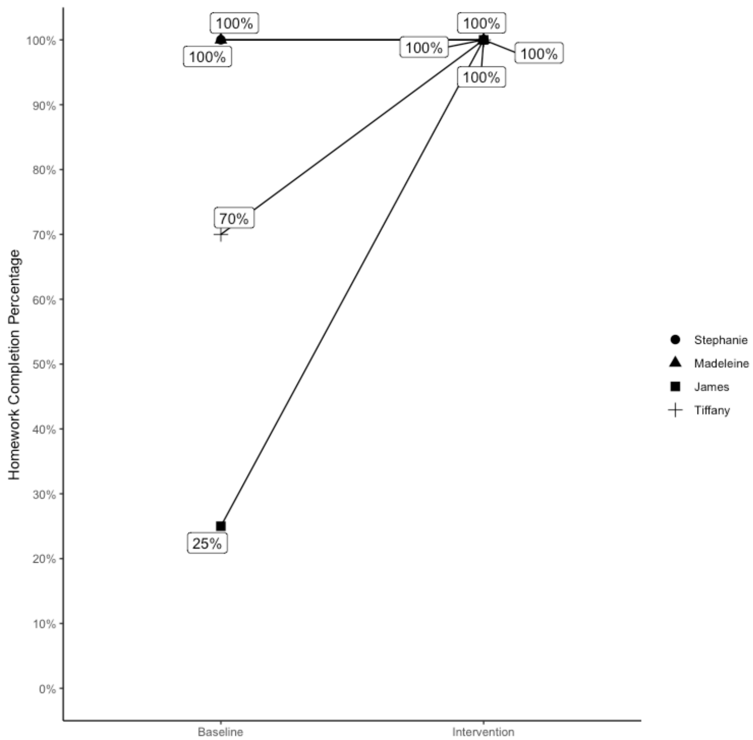


Table 23

Homework Completion for Each Participant

Participant	Baseline Phase Homework Completion Percentage	Intervention Phase Homework Completion Percentage	Total Homework Completion Percentage
Stephanie	100%	100%	100%
Madeleine	100%	100%	100%
James	25%	100%	57%
Tiffany	70%	100%	79%

Additional Analyses

Pre/Post Analysis of the Conners CATA

Prior to analysis, it was hypothesized that participants would improve their performance on the Conners CATA following the introduction of clinician-directed engagement practices. An RCI score was tabulated to compare pre- and post-performance differences on the Conners CATA for each participant. The RCI was calculated to determine the difference between scores at two different points in time, as the Conners CATA was administered during the initial intake session and in a follow-up session at the conclusion of the study. The Conners CATA provided scores for each participants ability to discriminate targets (*d'*), missed targets (*omissions*), incorrect responses to non-targets (*commissions*), incorrect responses before the target (*perseverative commissions*), response speed (*HRT*), response speed consistency (*HRT SD*), change in response speed across blocks of trials (*HRT Block Change*), and a *total score* (Conners, 1995). Each score includes a *T*-score value, which was used to calculate an RCI value comparing the two scores. Table 24 displays all of the Conners CATA *T*-score and RCI values obtained for each participant.

Stephanie. Prior to the baseline phase, Stephanie obtained the following *T*-scores: *d'* (*T*-score = 52), *omissions* (*T*-score = 46), *commissions* (*T*-score = 55), *perseverative commissions* (*T*-score = 46), *HRT* (*T*-score = 72), *HRT SD* (*T*-score = 33), *HRT Block Change* (*T*-score = 51), and a *total score* (*T*-score = 41). Following conclusion of the experimental phase, Stephanie obtained the following *T*-scores and RCI values: *d' T*-score = 38 (RCI = -24.27), *omissions T*-score = 45 (-0.28), *commissions T*-score = 44 (RCI = -1.16), *perseverative commissions T*-score = 45 (RCI = -1.67), *HRT T*-score = 60 (RCI = -0.3), *HRT SD T*-score = 34 (RCI = 16.34), *HRT Block Change T*-score = 52 (RCI = 41.18), and a *total score T*-score = 45 (RCI = 14.91).

Madeleine. Prior to the baseline phase, Madeleine obtained the following *T*-scores: *d'* (*T*-score = 75), *omissions* (*T*-score = 55), *commissions* (*T*-score = 81), *perseverative commissions*

(*T*-score = 65), *HRT* (*T*-score = 77), *HRT SD* (*T*-score = 67), *HRT Block Change* (*T*-score = 39), and a *total score* (*T*-score = 46). Following conclusion of the experimental phase, Madeleine obtained the following *T*-scores and RCI values: *d'* *T*-score = 65 (RCI = -15.41), *omissions* *T*-score = 54 (RCI = -0.35), *commissions* *T*-score = 64 (RCI = -1.54), *perseverative commissions* *T*-score = 49 (RCI = -26.67), *HRT* *T*-score = 64 (RCI = -0.4), *HRT SD* *T*-score = 57 (RCI = -199.69), *HRT Block Change* *T*-score = 42 (RCI = 96.68), and a *total score* *T*-score = 49 (RCI = 11.18).

James. Prior to the baseline phase, James obtained the following *T*-scores: *d'* (*T*-score = 75), *omissions* (*T*-score = 48), *commissions* (*T*-score = 90), *perseverative commissions* (*T*-score = 52), *HRT* (*T*-score = 69), *HRT SD* (*T*-score = 44), and a *total score* (*T*-score = 37). Following conclusion of the experimental phase, James obtained the following *T*-scores and RCI values: *d'* *T*-score = 78 (RCI = 4.62), *omissions* *T*-score = 48 (RCI = 0), *commissions* *T*-score = 46 (RCI = -3.98), *perseverative commissions* *T*-score = 90 (RCI = 63.33), *HRT* *T*-score = 54 (RCI = -0.46), *HRT SD* *T*-score = 61 (RCI = 339.47), and a *total score* *T*-score = 66 (RCI = 108.08).

Tiffany. Prior to the baseline phase, Tiffany obtained the following *T*-scores: *d'* (*T*-score = 59), *omissions* (*T*-score = 52), *commissions* (*T*-score = 59), *perseverative commissions* (*T*-score = 49), *HRT* (*T*-score = 90), *HRT SD* (*T*-score = 55), *HRT Block Change* (*T*-score = 71), and a *total score* (*T*-score = 49). Following conclusion of the experimental phase, Tiffany obtained the following *T*-scores and RCI values: *d'* *T*-score = 40 (RCI = -29.28), *omissions* *T*-score = 45 (RCI = -2.05), *commissions* *T*-score = 45 (RCI = -1.26), *perseverative commissions* *T*-score = 46 (RCI = -8.33), *HRT* *T*-score = 66 (RCI = -0.66), *HRT SD* *T*-score = 34 (RCI = -359.44), *HRT Block Change* *T*-score = 57 (RCI = -471.7), and a *total score* *T*-score = 39 (RCI = -37.27). Tiffany was the only participant to not obtain clinically significant *total score* RCI value, indicating mixed results.

Table 24

Conners CATA T-score and RCI Values

Participant	Measurement	T-score values		RCI Value
		Pre-baseline	Post-experimental	
Stephanie	d’	52	38	-24.27
Stephanie	Omissions	46	45	-0.28
Stephanie	Commissions	55	44	-1.16
Stephanie	Perseverative Commissions	46	45	-1.67
Stephanie	HRT	72*	60	-0.3
Stephanie	HRT SD	33	34	16.34*
Stephanie	HRT Block Change	51	52	41.18*
Stephanie	Total Score	41	45	14.91*
Madeleine	d’	75*	65	-15.41
Madeleine	Omissions	55	54	-0.35
Madeleine	Commissions	81*	64	-1.54
Madeleine	Perseverative Commissions	65	49	-26.67
Madeleine	HRT	77*	64	-0.4
Madeleine	HRT SD	67*	57	-199.69
Madeleine	HRT Block Change	39	42	96.68*
Madeleine	Total Score	46	49	11.18*
James	d’	75*	78*	4.62*
James	Omissions	48	48	0
James	Commissions	90*	46	-3.98

Table 24, continued

Participant	Measurement	T-score values		RCI Value
		Pre-baseline	Post-experimental	
James	Perseverative Commissions	52	90*	63.33*
James	HRT	69*	54	-0.46
James	HRT SD	44	61	339.47*
James	Total Score	37	66*	108.08*
Tiffany	d’	59	40	-29.28
Tiffany	Omissions	52	45	-2.05
Tiffany	Commissions	59	45	-1.26
Tiffany	Perseverative Commissions	49	46	-8.33
Tiffany	HRT	90*	66*	-0.66
Tiffany	HRT SD	55	34	-359.44
Tiffany	HRT Block Change	71*	57	-471.7
Tiffany	Total Score	49	39	-37.27

Note. T-score values greater than 65 and RCI absolute values exceeding 1.96 are considered clinically significant. *Denotes a clinically significant *T*-score and/or RCI value.

Analysis of Correct Versus Errored Responses

Prior to analysis, it was hypothesized that participants would increase the overall number of correct responses, while reducing the number of errored responses following the introduction of clinician-directed engagement practices. All correct and errored responses were collected across the study for each participant. Responses were averaged and divided to establish a correct response ratio for comparison across phases. Each participant increased in their correct response ratio between phases, supporting the initial hypothesis. Phase-specific response ratios are detailed in Table 25.

Table 25

Ratios of Correct to Errored Responses

Participant	Baseline Phase Correct Response Ratio	Experimental Phase Correct Response Ratio
Stephanie	4.945	7.180
Madeleine	3.614	6.209
James	2.900	3.441
Tiffany	4.246	5.654

Appraisal of Research Design

Within SCED it is essential that designs are evaluated to ensure that they adhere with established single-case criteria. To confirm sufficient methodological SCED adherence to published standards an evaluation tool was selected, the Risk of Bias in N-of-1 Trials (ROBiNT) scale (Tate et al, 2013). ROBiNT uses a 15-item scale that evaluates the rigor with which the design meets single-case parameters. Items are classified into two subscales: (1) internal validity and (2) external validity. Items are rated on a 3-point scale (0, 1, 2). Designs can receive a maximum score of 30 points, suggesting all criteria are met fully.

Table 26 presents the scores for items on the scale, subscale, and a summative score. The design for the current study received a total score of 22 out of 30 possible points. On the internal validity subscale, the design received a total score on of 11 out of 14 possible points. Four items of the subscale fully met criteria (design, blind assessors, inter-rater reliability, and treatment adherence), and the remaining three items partially met criteria (randomization, sampling of behavior, and participant/therapist blinding). On the external validity subscale, the design scored 11 out of 16 possible points. Four items of the subscale fully met criteria (baseline characteristics, dependent variable, raw data record, and data analysis), two items partially met criteria (independent variable and generalization), and one item did not meet criteria (replication).

Table 26

ROBiNT Scale for Design Appraisal

Item	Score	Rationale
Internal validity		
Design	2	At least three demonstrations of effect
Randomization	1	Entry into the experimental phase was randomized
Sampling of behavior	1	Less than five data points, but a minimum of three data points in the baseline phase; five data points in the treatment phase
Blinding (participant/therapist)	1	Only the patient was blinded to condition
Blinding assessors	2	Raters were blinded to conditions
Inter-rater reliability	2	25% of recordings in each phase sampled for inter-rater agreement with at least 80% agreement
Treatment adherence	2	Adherence ratings conducted by independent observers; development of a quantitative tool for measurement; a minimum of 20% of sessions were rated in each condition; demonstration of strong adherence to intervention
External validity		
Baseline characteristics	2	Provided a description of inclusionary participant characteristics and baseline clinical variables
Therapeutic setting	1	Sessions were conducted online via a telehealth platform with participation occurring within the home setting for each participant
Dependent variable	2	Precise and repeatable measures used with operational definitions, including specification of correct/incorrect criteria
Independent variable	1	Training was described and isolated from baseline condition; frequency of intervention applications varied
Raw data record	2	Performance data presented in an aggregated format
Data analysis	2	Systematic visual analysis completed in conjunction with quantitative calculations of effect size
Replication	0	No replication was incorporated into the study
Generalization	1	Generalization was measured via homework completion rates
Scores		
Internal validity	11 (79%)	
External validity	11 (69%)	
Total	22 (73%)	

CHAPTER V

Discussion

The purpose of the present study was to evaluate the impact of clinician-directed engagement practices on clinical and perceptual outcomes associated with cognitive rehabilitation. The current literature base on engagement within rehabilitation is sparce, with the primary body of research existing within the fields of psychology, physical therapy, and occupational therapy. Research has shown that client engagement in therapy is driven by a number of affective states, most prominently motivation and self-efficacy (Asimakopoulos et al., 2017; Miller & Moyers, 2017; Danzl et al., 2012). Therapeutic alliance has been shown to be a strong determiner in the promotion of motivation, self-efficacy, and patient engagement (Lawton et al., 2016; Morrison & Lent, 2018). However, there is a distinct absence of research into the application of engagement practices specific to the field of cognitive rehabilitation. To address this gap, the study incorporated a series of evidence-backed engagement enhancing strategies that targeted therapeutic alliance, motivation, and self-efficacy applied during cognitive rehabilitation session activities.

It was hypothesized that the introduction of clinician-driven engagement practices would improve performance on a series of therapy tasks that are typically part of a cognitive rehabilitation program. It was further hypothesized that participants would report greater perceptions of therapeutic alliance, motivation, and self-efficacy after sessions when the clinician had actively facilitated targeted engagement practices. Overall, the data supported the first hypothesis and provided weak to moderate support for the second hypothesis. This chapter provides an interpretation of the primary findings from study. This is followed by a discussion of identified contextual, methodological, and measurement limitations. The chapter concludes with a description of clinical implications and considerations for directions in future research.

Primary Contributions

Performance on Cognitive Rehabilitation Tasks

The primary research question sought to identify if the delivery of clinician-driven engagement practices would result in improved performance on a series of cognitive tasks targeting attention for individuals with chronic cognitive deficits following ABI. Findings showed a strong effect for changes in performance on attention drill exercises when the clinician implemented strategies such as providing specific and encouraging feedback, opportunities for task selection, and expressions of authentic positive regard in order to promote client engagement. Both visual and quantitative analyses support a strong effect for each participant. Visual analysis indicates a functional relation across attention drill exercises, supported by baseline stability with no observed threat to internal validity and demonstrations of immediacy of effect, changes in level, and an increasing trend upon entry into the experimental phase. Visual analysis was further supported by non-overlap and effect size calculations that indicate a strong effect across participants and exercises. This is a significant contribution, as engagement is not typically targeted as a central ingredient in cognitive rehabilitation. While current research provides general recommendations for clinical applications targeting motivation (Biel & Haley, 2023), self-efficacy (Ghazi et al., 2018), and therapeutic alliance (Lawton et al., 2018), there is a lack empirical evidence investigating the effects of systematic implementation of engagement practices targeting key affective states. The current findings support previous literature suggesting that when clinicians integrate specific techniques designed to increase motivation and self-efficacy patient performance will improve (Rajati et al., 2014; Robinson-Smith & Pizzi, 2012).

A secondary research question was established to probe whether an alternative cognitive rehabilitation task commonly applied within neurorehabilitation sessions resulted in improved performance following exposure to clinician-driven engagement practices. The phone application learning task was administered once in each condition, with demonstrated improvements across each participant upon the second administration in the experimental phase. Findings provide initial support for proof of concept across an alternative cognitive rehabilitation task. However, given the simple pre- post-comparison, further investigation is indicated.

Each of the clinician-driven engagement practices were selected and trialed to ensure feasible implementation during clinical interactions (e.g., when providing task instructions). For the purposes of the current study, we sought to identify a series of clinician-driven behaviors that did not result in excessive clinician burden, require significant behavioral modification, or interfere with existing clinical approaches. The identified approaches were found to easily and reliably layer onto common interactions that traditionally occur during neurorehabilitation sessions. Engagement practices were selected based on a theoretical model illustrating that increased drive and belief in one's capacity for success can improve performance (Lequerica & Kortte, 2010). The active and intentional use of engagement practices specifically selected to enhance therapeutic alliance and increase motivation and self-efficacy appeared to change performance.

The results suggest that promoting clinical engagement using a series of clinician-driven engagement practices enhanced participant performance. Improved performance was noted across all tasks, for each participant, providing preliminary evidence that a functional relation exists between clinician-driven clinical engagement practices and patient performance during neurorehabilitation tasks. When engagement practices such as providing encouraging feedback or promoting reflection on task performance are applied during clinical interactions, they resulted in improved performance outcomes. This represents a significant finding for the neurorehabilitation field.

Performance on Pre-Post Outcome Measure

The Conners CATA served as a probe to shed light on whether potential changes on repeated attention drills would be mirrored on a standardized attention test whose stimuli also consisted of decontextualized drills designed to evaluate sustained attention and working memory. The findings showed that three of the participants demonstrated significant improvements in their total scores between conditions suggesting that their improvements on the attention drills mirrored the improvements on the CATA. Tiffany was the only participant to exhibit a negative performance trend between conditions on the CATA. This might be accounted for by a significant gap in time between Tiffany's final clinical session and the administration of the post-test because of scheduling challenges. While the improvements on the intervention span tasks generally appeared to generalize to the Conners CATA results, this does not necessarily translate to efficacy or effectiveness data. The attention drills are similar to the CATA stimuli hence the drills could potentially be "teaching to the test." Research has been clear that for there to be a functional and meaningful change in cognitive rehabilitation, then therapy activities should provide high frequency repetition of meaningful and functional activities that are as similar as possible to the circumstance in which the skills will be used. Decontextualized drills have not been shown to generalize to functional activities (Sohlberg, Turkstra, & Hamilton, 2022).

Performance on Adherence Measure

Secondary research question five was concerned with the influence of clinician-driven engagement practices on adherence with homework completion. The findings provided further support for the impact of the selected engagement strategies. Two participants, Stephanie and Madeleine, exhibited strong homework completion rates in the baseline phase (100% completion), and maintained their rate of completion throughout the experimental phase. While James and Tiffany had varying rates of homework completion across the baseline phase, they both managed to increase their rates of homework completion following exposure to the clinician-driven engagement practices to 100% completion throughout the experimental phase.

Treatment Fidelity

A high level of treatment fidelity was noted among the two independent observers. This has several significant implications. High fidelity indicates that the intervention can be reliably and consistently applied during clinical applications. This also implies that it does not take significant training to identify the specific behaviors associated with the intervention. Each of the designated clinician-driven engagement strategies was reliably observed for the purposes of fidelity and measurement.

Effect of Engagement Strategies on Affective States

Secondary research questions two, three, and four focused on exploring the influence of clinician-driven engagement practices on perceptions of therapeutic alliance, motivation, and self-efficacy. Therapeutic alliance was measured by the WAI, while motivation and self-efficacy were measured using survey items developed by the principal investigator, modeled after Readiness Rulers, developed to support motivational interviewing (Moyers et al., 2009). In general, the findings provide mixed results for the hypotheses relevant to perceived changes in affective states following the experimental treatment. The only participant to consistently demonstrate responses in the expected trends across measures was Stephanie. The other participants tended to have occasional responses that aligned with expected trends or demonstrated strong response stability upon entry into the experimental phase. The greatest deviations in expected responses occurred with administration of the WAI.

Several possible explanations are suggested for the unanticipated findings that measures of affective states did not fully mirror improved performance on cognitive tasks following the implementation of the clinician-delivered engagement strategies.

Importantly, it is possible that the instruments did not provide a valid measurement of the intended affective states. Measures were selected for their face validity, but were not formally validated. The bond statements of the WAI were parsed out from the rest of the instrument, which may have inadvertently impacted the validity of responses. Additionally, while the WAI has been adopted as a common measure of alliance, it lacks empirical support. The motivation and self-efficacy survey items were generated by the researcher from clinical heuristics. Research suggests a myriad of factors that could impact the validity and reliability of survey development, including ineffectual wording of content, presenting content using a confusing layout, and providing insufficient response options (Rickards et al., 2012). In summary, we may not have had valid measures of therapeutic alliance, motivation, and self-efficacy.

Another possible reason that these measures did not show change in the expected direction may be due to the influence of specific participant profiles. It takes a certain degree of cognitive insight to read statements and judge their intent. The participants presented with varying levels of cognitive impairment. The ability to differentiate language subtilities when survey questions incorporated both positive and negative statements required higher level cognitive skills. This may have presented a challenge for the more severely impaired participants, James and Madeleine, which would account for the negative, downward trend in their responses to statements on the WAI. Another profile consideration that might interfere with survey responses is the participant's psychological state. For instance, Tiffany expressed on multiple occasions that they were experiencing negative self-perceptions, which may have resulted in challenges with accurately identifying and acknowledging their perceptions of therapeutic alliance, motivation, and self-efficacy. It is difficult to comment on factors associated with participant profiles with only four participants.

Potentially flawed assumptions underlying the model of affective states may be another possible consideration. It may be that there are unidentified moderators of motivation, self-efficacy, and therapeutic alliance that were not tapped by the selected engagement strategies. For example, perhaps the engagement strategies tapped into another construct, such as confidence or trust in the provider, which were not measured. The selected strategies were motivated by the theoretical model described Lequerica and Kortte (2010), but it may be that the strategies tapped into a different affective state. Related is the possibility, that the selected engagement strategies alone were not sufficient to promote a change on the affective measures. Personalized goal selection during therapy is one of the most studied engagement strategies in brain injury rehabilitation (Kucheria et al., 2022) and due to the nature of the experimental design, it was not included. Perhaps it needs to be part of the package in order to show change on these measures.

A change in how survey items were examined may have also revealed a stronger relationship between affective states and the experimental condition. For example, analysis of single survey items may have enhanced findings to allow for identification of which statements are most effective at capturing intended affective states, rather than analyzing statements collectively. For instance, the statement, *I felt motivated throughout the session*, may have been more accurate in capturing participant perceptions of motivation as compared with alternative statements, such as, *I gave my best effort throughout the session*. Participants may have also found that the statements were not sufficiently representative of their own affective perceptions or felt self-conscious about scoring statements due to fear of insulting the clinician. These barriers might have benefitted from utilizing a more objective approach towards measuring affective states. Additionally, the frequency and repetition of measuring affective states every session may have been off-putting for some participants, resulting in rushed survey completion or a lack of meaningful performance reflection.

A final consideration is that comments made by participants frequently confounded many of the unanticipated survey responses. Qualitative data was collected by recording sessions and relevant quotes were transcribed by research assistants. While not formally analyzed for this dissertation study, informal analysis of qualitative comments suggests that participants' perceptions of therapeutic alliance, motivation, and self-efficacy more closely aligned with expected trends. This indicates a potential defect in the accuracy of selected measures of the targeted affective states. The intention is to subsequently conduct a mixed methods analysis and comparison of qualitative statements with survey responses (Onghena et al., 2019).

Limitations

Although the preliminary findings offer compelling evidence for the effect of clinician-driven engagement practices on clinical performance, findings should be interpreted with caution. This section highlights limitations and challenges that impacted the design of the study, strength of the presented evidence, and conclusions. Limitations are described in terms of (1) contextual factors, (2) methodological factors, and (3) measurement factors. It is important to note that these factors can weaken the overall strength and generalizability of the results.

Contextual Factors

A primary contextual consideration is the limitation of targeting clinical engagement via a telehealth platform. Due to COVID-19 restrictions, all sessions were conducted online, potentially restricting the perceived application of engagement practices. However, preliminary evidence is showing that telehealth can result in increased patient engagement (Lawson et al., 2022; Kettlewell et al., 2021). Future comparative studies should be conducted to identify differences in applications and outcomes of engagement practices via telehealth versus in-person sessions.

Methodological Factors

While SCEDs can efficiently and effectively assess the effects of an experimental variable, there are known limitations within SCED. Some common disadvantages, particularly among AB designs, include irreversible effects, generalization from one condition to another condition, and challenges with interpretation related to carryover effects, interaction effects, and order effects (Byiers et al., 2012). While the current study appears to have successfully isolated the intervention between conditions, the intervention could not be effectively reversed or withdrawn following exposure without anticipated carryover effects.

While a small sample size met the criteria established in SCED of adequate demonstrations of effect (Kratochwill, 2010), a larger sample size would strengthen the statistical power and generalization of findings. Study power could also be amplified with additional opportunities for randomization and an increased number of sessions within each condition. Inclusion of a maintenance phase would provide additional information about the impact of the clinician-driven engagement practices. Importantly, applying these findings within a group design, such as an interrupted time series (ITS) design, would increase methodological rigor, generalizability, and power (St. Clair et al., 2014).

It is difficult to interpret participant perceptions of therapeutic alliance, motivation, and self-efficacy due to methodological issues. For instance, therapeutic alliance evolves over time (Escudero, 2022), and even if there had been positive perceptual changes in all four participants, it might have been a function of having multiple sessions with a clinician regardless of whether engagement practices were added.

Measurement Factors

As previously noted, examination into the influence of relational and affective factors associated with clinician-driven engagement practices may have been limited by the measurement tools. The WAI contains only 12 items examining perception of therapeutic bond, which may not have been sufficient to capture the influence of specific engagement practices on perceptions of alliance. Alternative measures of working alliance, including the use of tools that evaluate clinician perception of working alliance may be useful for future studies. The two survey items developed by the principal investigator would have benefitted from being piloted prior to implementation for refinement. Piloting each measure would have facilitated greater validity, reliability, and precision in measurement. The identification of objective measures that validly assess participant and clinician perceptions of alliance as well as evaluate their level of motivation and self-efficacy would increase knowledge about the potential impact of promoting engagement during therapy.

Clinical Implications

This dissertation expands upon existing research suggesting that rehabilitation outcomes can be influenced by a client's affective state (Forgea, 2021; MacDonald et al., 2013). The study examined the potential effect of specific clinician behaviors designed to target underlying affective states that were hypothesized to increase client engagement on therapy tasks and in so doing improve clinical performance. Clinicians might assume that the identified clinician-driven engagement practices evaluated in this dissertation generally represent good clinical practices, that effective clinicians should automatically incorporate, thus there is no need for them to be further assessed. For example, it is not unreasonable that practitioners would believe that delivering bonding statements and making specific affirmations about performance are common and routine. Unfortunately, however, research has consistently revealed that communication practices to increase motivation and self-efficacy are not routinely or consistently embedded in clinic practice and require training (Oliveira et al., 2015). Fortunately, evidence shows that effective implementation of specific engagement enhancing practices responds to training (Anderson et al., 2022; Kucheria et al., 2022; Perlman et al., 2020). Despite being self-evident, there are no clear, evidence-backed guidelines for applying behaviors that engage targeted affective states. This study supports the application of specific engagement practices and shows that they are discreet, observable, and trainable. The significance of the study findings provides sufficient support for further empirical investigation.

Future Directions

As previously discussed, next steps would include a mixed methods analysis of existing data related to affective states. Analysis would include examination into single survey items to establish measurement accuracy for comparison with spontaneous statements made by participants across conditions. The goal would be to then develop a RCT group design to include a greater number of participants, incorporation of multiple conditions, and provide an opportunity for longitudinal data collection, which would strengthen both internal and external validity (St. Clair et al., 2014). The study would also seek to address contextual and methodological variables. For instance, training multiple clinicians to administer engagement strategies within various clinical contexts, including in-person and telehealth settings.

In future studies, measures should also be identified or developed to assist with specifying the specific contributions each clinician-driven behavior has on patient motivation, self-efficacy, therapeutic alliance, and clinical performance. For example, it is not known whether implementing just one or two of the engagement practices would have produced the same effect. It will also be important to assess whether these findings generalize to alternative skill training and content areas, including translation to other allied health professions. Future analyses should also consider alternative measures of affective responses, such as examining non-verbal responses to the intervention package via video recordings.

Conclusion

This dissertation study provides some of the first data that clinician-directed engagement practices can have a significant influence on patient performance during cognitive rehabilitation. Operationalizing and measuring the potential impact of treatment ingredients that enhance patient engagement could have significant implications for the future development of clinical treatment approaches, anticipated clinical outcomes, and clinical training programs. Establishing evidence that the rehabilitation practitioner can systematically implement specific techniques and strategies that promote and enhance engagement would not only revolutionize how we engage patient populations throughout the rehabilitation process, but directly influence how patients engage in their own recovery processes, potentially resulting in increased long-term and sustained clinical outcomes.

APPENDIX A

Dissertation Fidelity Tool

Modified from the EMR-ARF (Bland et al., 2016)

Client code: Date: Circle one: Baseline / Experimental Session Duration: Session #:

Clinician Behaviors BEFORE A TASK	Observed?			Number of Observations, if applicable
	Yes	No	N/A	
1. Provided a basic greeting				
2. Added a bonding statement to greeting				
3. Added an active listening statement				
4. Provided participant with a task choice				
5. **Provided a task buy-in statement**				
6. Provided an opportunity for strategy selection				
7. Provided performance prediction opportunity				
8. Provided initial scripted activity instructions				
DURING A TASK				
1. Provided ongoing scripted activity instructions				
2. Provided performance affirmation				
AFTER A TASK				
1. Conducted a task reflection				
2. Provided positive regard statement regarding performance				
3. Transitioned into next drill/task utilizing script (if applicable)				
4. Provided instructions/reminder for homework at conclusion of final task				

****Bolded clinician behaviors serve as intervention behaviors****

APPENDIX B

Task Analysis Activities

Task 1: Time Timer

1. Swipe left on the screen	
2. Select the Productivity folder	
3. Select the Time Timer app	
4. Swipe right on the existing time	
5. Select the trash can icon	
6. Select Ok	
7. Click the + sign in the top right corner	
8. Click New Timer at the top of the screen	
9. Click the X	
10. Type in a name for the activity being timed	
11. Select Done	
12. Drag the line under “0” to set the timer	
13. Select the gear icon second from the right on the bottom	
14. Select the Tone	
15. Change the tone	
16. Click Study in the upper left corner	
17. Select Disk Color	
18. Change the color	
19. Click Study in the upper left corner	
20. Select Save in the upper right corner	
21. Swipe up on the screen	
22. Swipe up on the application to close app	

Task 2: Focus Keeper

1. Swipe left on the screen	
2. Select the Productivity folder	
3. Select the Focus Keeper app	
4. Select three dots by existing timer	
5. Select Delete This Task	
6. Select All Tasks	
7. Select Delete	
8. Select + New Task	
9. Type in name of task (Study)	
10. Select day/s to do the task (the day of the week)	
11. Select Done to go back to homepage	
12. To start the timer, press the start button below the task	
13. Press the circle with an arrow in the middle of the screen to pause	
14. Press the circle with an arrow again to resume	
15. Press the circle with an arrow in the middle of the screen to pause	
16. Press the circle with “skip” to skip to the next break	
17. Select Skip	
18. Press the circle with an arrow in the middle of the screen to pause	
19. Press the circle with “End” to end the session	
20. Select End	
21. Swipe up on the screen	
22. Swipe up on the application to close app	

APPENDIX C

Modified Working Alliance Inventory

	Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
I felt uncomfortable with Aaron.							
Aaron and I understood each other.							
I believe Aaron liked me.							
I believe Aaron was genuinely concerned for my welfare.							
Aaron and I respected each other.							
I feel that Aaron was not totally honest about his feelings toward me.							
I was confident in Aaron's ability to help me.							
I feel that Aaron appreciated me.							
Aaron and I trusted one another.							
My relationship with Aaron was very important to me.							
I had the feeling that if I said or did the wrong things, Aaron would stop working with me.							
I feel Aaron cared about me even when I did things that he did not approve of.							

APPENDIX D

Motivation Survey Items

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I felt motivated throughout the session.							
I was able to persist when I found the activities to be challenging.							
I gave my best effort throughout the session.							
The session activities are meaningful and important to me.							

APPENDIX E

Self-Efficacy Survey Items

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Doing well is important to me.							
I felt capable of successfully completing session activities.							
I could have tried harder.							
I am concerned about my performance on the session activities.							

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