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Changing Brains, Changing Lives: Researching the Lived Experience of Individuals Practicing Self-Directed Neuroplasticity

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Individuals Practicing Self-Directed Neuroplasticity

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St. Catherine University

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Dedication

This work is dedicated to our study participants.

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Abstract

Neuroplasticity refers to the brain's ability to change and adapt both structure and function in response to sensory experiences. Self-directed neuroplasticity (SDN) specifically addresses the capacity to proactively modify cerebral function through volitional control and the intentional practice of focusing attention in desired ways. In other words, the mind can consciously change the brain. Self-directed neuroplasticity (SDN) approaches are successfully used to treat a range of challenges such as obsessive-compulsive disorder (OCD), depression, and emotional response regulation. However, no research describes the lived experiences of individuals practicing SDN across multiple modalities. Using semi-structured, in-depth interviews, this phenomenological inquiry describes the lived experiences of 13 participants practicing SDN. In addition to identifying SDN uses and multifaceted aspects to SDN practices outside of current academic literature, this study utilized thematic analysis to uncover four themes: *Seeking*, *Empowerment*, *Growth in Relationships*, and *Transformation*. Results offer insights into expanding SDN uses, broadening practice context, and life-changing transformation. Implications include the need to increase awareness, education, and integration of SDN within holistic health and other communities, as well as expand research regarding SDN uses, application among various populations, and longitudinal efficacy.

Keywords: Self-directed neuroplasticity, neuroplasticity, phenomenology, Hebbian theory, volition, mindfulness, transformation

Introduction

The idea that the brain can change its own structure and function through thought and activity is, I believe, the most important alteration in our view of the brain since we first sketched out its basic anatomy and the workings of its basic component, the neuron. (Doidge, 2007, pp. xix-xx)

Neuroplasticity is the brain's remarkable ability to adapt and rewire neural pathways throughout the lifetime as a result of thoughts, actions, or experiences (Costandi, 2016). While many early scientists and medical professionals believed the human brain to be a fixed structure with a finite number of neurons, the current field of neuroscience offers an abundance of data to the contrary (Fuchs & Flügge, 2014; Pascual-Leone et al., 2005; Shaw, Lanius, & Van den Doel, 1994; Voss, Thomas, Cisneros-Franco, & de Villers-Sidani, 2017). Neurons are the nerve cells that form the circuits of the brain (Nicholls et al., 2012). Synapses are the gaps between these cells that link them together, creating neural pathways (LeDoux, 2003). Repetitive firing along the same neural pathways within the brain creates stronger connections and organization of neurons. Put simply, neurons that fire together, wire together (Hebb, 1949). Long-term potentiation (LTP) results from new learning that strengthens connections between neurons (Bliss & Lømo, 1973; Lømo, 2003). Conversely long-term depression (LTD) refers to the process of "unlearning" through disconnections of neurons. A healthy brain requires both LTP and LTD to maintain balance (Abraham & Bear, 1996; Pérez-Otaño, & Ehlers, 2005).

Neuroplasticity can be either adaptive, related to a positive gain in function (Cohen et al., 1999) such as regaining motor skills after a stroke, or maladaptive, which results in loss of function (Nudo, 2006) like the neuroplastic changes related to chronic pain (Denes, 2016; Flor, Braun, Elbert, & Birbaumer, 1997; Seifert & Maihöfner, 2011). Any repeated stimulus, whether positive or negative, has the potential to affect neuroplastic changes, ultimately leading to automatic responses or habits (Dispenza, 2012). Because humans evolved to focus on potential

threats to life or safety (Fessler, Pisor, & Navarrete, 2014), we now tend to pay more attention to negative situations, no matter how insignificant (Baumeister, Bratlavsky, Finkenauer, & Vohs, 2001; Kanouse & Hanson, 1972; Lewicka, Czapinski, & Peeters, 1992; Rozin & Royzman, 2001). Constant focus on negative experiences adversely affects emotional health (Edwards, 2017) and leads to "negative, limiting, and fear-based thought patterns" (Wimberger, 2014, p. 10), also known as deceptive brain messages (Schwartz & Gladding, 2011). The more frequently these brain messages occur, the more the brain believes they are required for survival, regardless of the content (Van der Kolk, 1994). Consequently, the brain creates the urge to continue these thoughts and behaviors (Schwartz & Gladding, 2011). These habitual thoughts and behaviors lie in the unconscious mind, which acts as the brain's autopilot (Lipton, 2005). Fortunately, with effort, humans can tap into the analytical side of the conscious mind (Lipton, 2005) and employ self-directed processes to promote positive neuronal change (Schwartz & Begley, 2002).

Self-directed neuroplasticity (SDN) is the mind's ability to change brain function through the power of thought and can alter brain structure in potentially beneficial ways, overcoming habituated and maladaptive responses (Schwartz & Begley, 2002). SDN first appeared in the academic literature as a successful means of treating obsessive compulsive disorder (OCD) (Baxter et al., 1992; O'Neill & Schwartz, 2004; Saxena, Brody, Schwartz, & Baxter, 1998; Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996; Schwartz, 1997; Schwartz, 1998). Academic literature further supports components of SDN successfully addressing a number of other issues, including depression (Segal, Williams, & Teasdale, 2002; Teasdale et al., 2002), spider phobias (Paquette et al., 2003), and regulation of emotional response (Beauregard, Lévesque, & Bourgouin, 2001; Lévesque et al., 2003; McRae, Jacobs, Ray, John, & Gross, 2012; Ochsner, Bunge, Gross, & Gabrieli, 2002; Paquette et al., 2003; Schwartz, 1997). A majority of the

literature on SDN lies in the popular press, demonstrating SDN's ability to address challenges such as trauma (Wimberger, 2014), increasing happiness (Hanson, 2013), and false brain messages (Schwartz & Gladding, 2011).

A variety of SDN approaches exist and they share the common principles of focused attention, mindful awareness, volition, redirection of thoughts and actions, and consistent effort (Hanson, 2013; Schwartz & Gladding, 2011; Wimberger, 2014). Focusing attention on specific thoughts and actions by utilizing the executive attention network allows for regulation of emotional and physical responses (Rueda, Posner, & Rothbart, 2005). Mindfulness is a specific approach of focusing attention by "paying attention in a sustained and particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 2012, p. 1). It is the skill that permits one to identify unhelpful thoughts as only existing within the mind, without attachment to the belief that they are true events that one must act upon (Chambers, Gullone, & Allen, 2009). Once an individual is able to mindfully identify unhelpful thoughts or behaviors, they can choose a more adaptive response through the power of volition or free will (Pierson & Trout, 2017) by redirecting thoughts and actions (Schwartz & Gladding, 2011). Consistently applying effort towards these steps rewires the brain to more adaptive automatic responses through the principles of Hebbian theory and the quantum Zeno effect (Chancellor-Freeland, 2006; Schwartz & Gladding, 2011). Even so, resistance to change in the brain is common (Mahoney, 2004). In seeking to conserve energy, the brain resists the formation of new neuronal connections in order to retain its current state (Allen & Schwartz, 2007). Therefore, one needs to apply hard work and consistent effort in order to achieve desired outcomes (Schwartz & Gladding, 2011). With this in mind, the purpose of this research project is to describe the lived experience of individuals practicing self-directed neuroplasticity.

Next, we review the literature as it relates to self-directed neuroplasticity. Following the literature review, we examine how our theoretical, as well as personal and professional lenses, contributed to the design, implementation, and interpretation of our project. Then, we outline the design of our research method. We follow with a review of our results. Finally, we conclude with a discussion of results and related implications.

Literature Review

The purpose of this chapter is to review the available literature related to self-directed neuroplasticity (SDN). We begin this review by providing an overview of neuroplasticity, including a description, an explanation of neurons and synapses, an introduction to Hebbian theory and homeostatic plasticity, and the mechanisms of long-term potentiation (LTP) and long-term depression (LTD). Next, we review adaptive and maladaptive processes as they relate to neuroplasticity, specifically the negativity bias and the concept of false brain messages. Then, we explore the nuances of the mind and the brain. Building on this foundation, we introduce SDN and highlight the foundational roles of attention, mindfulness, volition, redirection, and consistency. Lastly, we review SDN within the context of human practice and acknowledge the limited research available describing the lived experience of individuals utilizing these practices.

Overview of Neuroplasticity

In this section, we first describe how neuroplasticity occurs with "many variations, in many forms, and in many contexts" (Cramer et al., 2011, p. 1591). Next, we look at two key components of neural circuitry, neurons, and synapses. We then introduce Hebbian theory and homeostatic plasticity. Finally, we investigate the foundational mechanisms of long-term potentiation (LTP) and long-term depression (LTD).

Description of neuroplasticity. Neuroplasticity, or brain plasticity, is the means through which our brains change. Once considered fixed and unchangeable, we now recognize that the brain has the capacity to modify and adapt in both structure and function, in response to different sensory experiences (Fuchs & Flügge, 2014; Pascual-Leone et al., 2005; Shaw, Lanius, & Van den Doel, 1994; Voss, Thomas, Cisneros-Franco, & de Villers-Sidani, 2017). Neuroplastic

change occurs throughout the lifetime in response to any stimulus, thought, or experience (Bach-y-Rita, 1972; Eriksson et al., 1998; Jenkins, Merzenich, Ochs, Allard, & Guíc-Robles, 1990).

Shaw and McEachern (2013) describe neuroplasticity as an umbrella term that refers to the many ways in which the nervous system is constantly changing. For this reason, it is important to provide context when depicting the mechanisms of neuroplasticity. For example, Maguire et al. (2000) show that London taxi drivers have larger hippocampi when compared to bus drivers. This section of the brain, in addition to being one of the most plastic (Sherin & Nemeroff, 2011), is also responsible for learning routes and spatial representation (Moser, Kropff, & Moser, 2008). The longer the length of time an individual operates as a taxi driver, the greater the hippocampal volume (Maguire et al., 2000). Another example of brain plasticity, according to Batouli and Saba (2017), shows that at least 80 percent of brain grey matter is modifiable by physical activity. In yet another study, Beilharz, Kaakoush, Maniam, and Morris (2018) conclude that the ingestion of probiotics, recognized for their influence on intestinal microbial balance, contributes to brain mechanisms affecting improvement of memory tasks. These studies represent only a few of the various influences on neuroplasticity. The brain's ability to change, in multiple ways, in response to every experience we have, occurs continuously throughout the course of adult life. "Neuroplasticity is an intrinsic and fundamental property of all nervous systems" (Costandi, 2016, p.2). To further understand brain plasticity, we look at two core components of the brain: neurons and synapses.

Neurons and synapses. Neurons, or nerve cells, are the building blocks that form circuits in the brain (Nicholls et al., 2012). Each neuron averages around ten thousand connections that directly link it to other neurons (Kandel, Schwartz, & Jessell, 2000). At the most basic level, billions of connected neurons build circuitry that "stores memories, creates emotional reactions,

initiates thought processes, and produces actions" (Pittman & Karle, 2015, p. 30). Neurons, capable of changing structures and patterns in response to experience, are the reason we have neuroplasticity. A synapse is the tiny gap between neurons that functionally links them together. These synaptic connections help build the linkages that become the intricate architecture of the brain (LeDoux, 2003). The brain is dynamic, constantly changing synaptic interconnections in response to experience (Doidge, 2007). LeDoux (2003) argues that personality development is determined at the synaptic level leading him to declare, "You are your synapses" (p. ix). All brains have neurons and synapses, but the networks that they create are as unique to an individual as a fingerprint. Hebb (1949) proposed a theory of how neurons create circuitry and today that theory, known as Hebbian theory, has been distilled into the simple statement: Neurons that fire together, wire together (Shatz, 1992).

Hebbian theory and homeostatic plasticity. To build connections between neurons, one neuron needs to be firing at the same time another neuron is firing. A pattern of circuitry, or neuronal structure, develops when neurons fire together, and the synaptic connection between them strengthens. When both neurons fire at the same time, especially if done repeatedly, chemical changes occur in both, creating a link. This is the foundation of all learning (Hebb, 1949). Doidge (2007) suggests that it was Freud who proposed an earlier version of Hebb's theory in 1888 when he called it the "law of association by simultaneity" (p. 334). Freud stressed that what links neurons is their firing together in time. In other words, an association takes place when neurons simultaneously fire in an ongoing manner (Bloom, 1967; Freud et al., 1966; Markowitz, 1977). Allport (1985) submits that if the same pattern of activity in the brain occurs repeatedly, then the pattern will become auto-associated. For example, the brain might associate popcorn with Coca-Cola, or dogs with feelings of joy and happiness. Conversely, if someone has

an experience with a dog that they perceive negatively, such as an attack, the brain may link or associate dogs with feelings of fear or danger. A single thought or experience causes groups of neurons, also called cell assemblies (Milner, 1996), to fire together and remain active at the same time leading to jungles of neural networks in the brain (Dispenza, 2015).

Hebbian synaptic plasticity, widely considered to be the most influential foundational mechanism for storing information in the nervous system (Fox & Stryker, 2017), corresponds with a lesser known theoretical phenomenon known as homeostatic plasticity (Davis, 2006; Pozo & Goda, 2010; Turrigiano, 2008). The definition of homeostatic plasticity is broadly defined by Fox and Stryker (2017) as "neuronal change that tends to return the neuron back towards an initial set point" (para. 2). While Hebbian plasticity leads to a positive-feedback process during activity, thus increasing synaptic gain, homeostatic plasticity involves negative feedback that moves the neuron back towards its original state (Fox & Stryker, 2017; Zenke & Gerstner, 2017). Murphy and Corbett (2009) recognize the potential role of homeostatic plasticity in stroke recovery patients. Homeostatic mechanisms, particularly in the first few days or weeks after stroke, might reset or restore activity in stroke-affected parts of the brain (Murphy & Corbett, 2009).

This regulation is important because the positive-feedback loop resulting from Hebbian plasticity may result in the unwanted side effect of hyperexcitability in the brain which can severely disrupt circuit function (Miller & MacKay, 1994; Turrigiano & Nelson, 2004; Vitureira & Goda, 2013). Homeostatic plasticity, on the other hand, works to maintain neuronal homeostasis and previously established connectivity by constraining network activity (Watt & Desai, 2010). The two forms of plasticity often work in contrasting directions to maintain balance through flexible neural function. It is useful to understand how both forms of plasticity

coordinate stability in the brain; however, not all forms of synaptic plasticity fall precisely into either Hebbian or homeostatic theories of plasticity (Turrigiano, 2017). Building on this knowledge, we next discuss the foundational mechanisms of long-term potentiation (LTP) and long-term depression (LTD).

    Long-term potentiation and long-term depression. In our review of synaptic plasticity, we consider two other foundational mechanisms: long-term potentiation (LTP), and its complementary process, long-term depression (LTD). When we learn something new, neurons fire and wire together which strengthens the connections between neurons; we call this long-term potentiation (LTP) (Bliss & Lømo, 1973; Lømo, 2003). Alternately, when the brain "unlearns associations and disconnects neurons" (Doidge, 2007, p.117), we engage in long-term depression (LTD). Learning and unlearning, respectively regarded in terms of plasticity, are essential in the human brain. If we engage only in learning and strengthening of connections, our neuronal networks can become saturated (Abraham & Bear, 1996; Pérez-Otaño & Ehlers, 2005). Rosenzweig, Barnes, and McNaughton (2002) suggest that to make room for new memories in our brain circuitry, we must unlearn existing memories. Doidge (2007) gives the example of falling in and out of romantic love, whereby both learning and unlearning are required at a neural level as the plastic reorganization of millions of neural networks involving emotions, sexuality, and the self occurs. Sometimes, people are unable to move forward because they are not able to unlearn patterns of neural networks that are wired together in the brain. Therefore, we next describe how neuroplastic change can be both adaptive and maladaptive.

Adaptive and Maladaptive Plasticity

    In this section, we first examine how neuroplasticity contributes to both adaptive and maladaptive processes depending on the organization of neural networks, particularly in response

to stress. We then explore the brain's negativity bias and how it can lead to maladaptive neural networks. Next, we discuss the relationship between maladapted neural networks and false brain messages.

Adaptive and maladaptive processes. Brain plasticity, in response to individual and environmental (Davidson & McEwen, 2012; Selhub & Logan, 2012) experience, can be either adaptive or maladaptive. Adaptive plasticity is associated with a positive gain in function (Cohen et al., 1999), while maladaptive plasticity is associated with negative consequences such as loss of function (Nudo, 2006). Cramer et al. (2011) state, "Not all plasticity has a positive impact on clinical status—in some cases, plasticity might have negative consequences" (p.1593). Taub et al. (2006) show the adaptive ability of the brain to work around damaged neurons by assigning other areas of the brain to take over function in stroke patients. The most cited example of maladaptive neuroplasticity is that of chronic pain where disruption in neural circuitry persists even after the disappearance of the source of the pain (Denes, 2016; Flor, Braun, Elbert, & Birbaumer, 1997; Seifert & Maihöfner, 2011).

Adaptive and maladaptive processes are particularly evident in response to stress (Cramer et al., 2011; Deppermann, Storchak, Fallgatter, & Ehlis, 2014; Johnson, Jones, & Gliga, 2015; Sinha, Lacadie, Constable, & Seo, 2016). Stress is an organism's physiological response to any contextual change (Daruna, 2012; Sapolsky, 2004). Both real and imagined threats activate the stress response (Seaward, 2015). Stress is also on the rise, with almost half of Americans reporting that their stress levels have increased in the past five years (AIS, 2018). The fight-or-flight mechanism triggers when a threat is perceived. Acute stress is transient, brief and can be positive and lifesaving in threatening situations (McEwen, 1998). However, when the acute

stress response does not resolve, stress becomes chronic (Salleh, 2008; Sapolsky, 2004). Our response to chronic stress ultimately leads to changes in the brain.

Notable changes in brain structure occur in individuals exposed to chronic stress (Conrad, Magariños, Ledoux, & McEwen, 1999; Davidson, 2000; Drevets, 2006; Gray, Milner, & McEwen, 2013; McEwen, Nasca, & Gray, 2016; Pruessner et al., 2008; Radley, Morilak, Viau, & Campeau, 2015; Vyas, Jadhav, & Chattarji, 2006; Wang et al., 2005). These changes do not always reverse, even after the stressor is removed (McEwen & Gianaros, 2010). An adaptive stress response appropriately corresponds with the level of perceived threat in a stressful situation and allows the organism to cope in a way that promotes resilience throughout life (Radley, Morilak, Viau, & Campeau, 2015). A maladaptive response, however, may result from a profoundly stressful or traumatic event. This can lead to a chronically triggered survival system in the brain (de Kloet, Joëls, & Holsboer 2005; Finsterwald & Alberini, 2014). Boals, Hayslip, and Banks (2014) explain that people naturally remember negative events more than positive ones due to a negativity bias.

The negativity bias. As a means of survival, our brains evolved to heavily attune to the possibility of threat (Fessler, Pisor, & Navarrete, 2014). This resulted in a general psychological principle known as the negativity bias. The negativity bias is the tendency for humans to pay more attention or give more weight to negative experiences than neutral or positive experiences. Humans tend to focus on the negative even when the experiences are inconsequential (Baumeister, Bratlavsky, Finkenauer, & Vohs, 2001; Kanouse & Hanson, 1972; Lewicka, Czapinski, & Peeters, 1992; Rozin & Royzman, 2001). The brain reacts more strongly to negative stimuli because there is a greater surge in electrical activity; therefore, negative news more heavily influences our attitudes than positive news (Ito, Larsen, Smith, & Cacioppo, 1998).

For example, a young child that is picked up on time every day after school for a year might only remember or assign greater significance to the one time a parent is late. Hanson and Mendius (2009) explain, "The brain is like Velcro for negative experiences but Teflon for positive ones" (p. 68). Left unchecked, the neural circuitry emerging from a negativity bias, depending on how frequently it fires, can become a serious burden on emotional wellbeing (Edwards, 2017). Over time, after many negative experiences, the brain sensitizes to more negative experiences (Asprey, 2016). In other words, pain today tends to lead to more pain tomorrow (Hanson & Mendius, 2009). Given the negativity bias of the brain, we next discuss how brain messages can sometimes be false.

False brain messages. Networks of neurons can fire and wire together in ways that are not always adaptive (Hermans et al., 2011). The more a network of neurons fire together, the more it becomes hardwired in the brain. Hebb's law dictates that the more nerve cells repeatedly activate, the easier it becomes for them to fire in unison (Hebb, 1949). Dispenza (2012) says that, over time, whatever thought, behavior, or feeling repeatedly occurs becomes "automatic, unconscious habit" (p. 45). Bundles of nerve cells that fire repetitively structure themselves into specific patterns with long-lasting connections (Dispenza, 2012). These patterns come in very handy when you consider something as simple as tying your shoes; without the automated pattern of shoe tying, it would take considerably longer to get your shoes tied (Wimberger, 2014). Further examples of automated brain patterns include driving, typing, and brushing your teeth. However, the brain can also build maladaptive networks that lead to "negative, limiting, and fear-based thought patterns" (Wimberger, 2014, p. 10) that may not be true or helpful.

As previously discussed, in response to chronic stress, the brain becomes wired into a state of constant crisis and emergency. A perpetual state of fight or flight can cause damaging

levels of inflammation (Cohen et al., 2012) and immune dysfunction (Cole et al., 2007; Kiecolt-Glaser, Speicher, Holliday, & Glaser, 1984; Merchant, 2013). It is typically a single event of extreme stress that triggers post-traumatic stress disorder (PTSD) (Rauch, Shin, & Wright, 2003), a disorder that develops in some people who have experienced a traumatic event (National Institutes of Health [NIHS], 2019). The brain, so overwhelmed in the moment, doesn't have the capacity to file the event into the past, causing a disorganization of neural networks (Rauch, Shin, & Wright, 2003). As a result, individuals with PTSD may experience intense, involuntary distress when exposed to internal or external cues that resemble an aspect of the traumatic event. Physiological reactions may occur along with persistent and exaggerated negative beliefs about the safety of the world (Anxiety and Depression Association of America [ADAA], 2018). These falsely perceived perceptions in the brain can be deceptive and may lead to potentially devastating consequences in health and wellbeing (Schacter & Scarry, 2001).

Schwartz (2011), a pioneer in the field of neuroplasticity, inspired the term, *deceptive brain messages* and describes them as, "Any false or inaccurate thought or any unhelpful or distracting impulse, urge, or desire that takes you away from your true goals and intentions in life" (p. 4). Of Schwartz's many contributions in the realm of neuroplasticity, perhaps most groundbreaking is the research on the treatment of obsessive-compulsive disorder (OCD) (Baxter et al., 1992; O'Neill & Schwartz, 2004; Saxena, Brody, Schwartz, & Baxter, 1998; Schwartz, Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996; Schwartz, 1997; Schwartz, 1998). Mayo Clinic (2018) defines OCD as a neuropsychiatric disease marked by patterns of unreasonable thoughts and fears (obsessions) that trigger intense urges to perform ritualistic and repetitive behaviors (compulsions). Obsessive compulsive disorder aptly represents how deceptive, or false, brain messages can intrude on the psyche and take over a life. The more a thought, action,

or inaction is repeated, the more habituated it becomes in the brain. The more often a habit is repeated, the more the brain thinks it's essential for survival (Van der Kolk, 1994). The brain does not distinguish whether a thought or action is helpful or unhelpful, or adaptive or maladaptive. It only responds to how you behave and "generates strong impulses, thoughts, desires, cravings, and urges that compel you to perpetuate your habit whatever it may be" (Schwartz & Gladding, 2011, p. xii). This can lead a person to believe things that aren't necessarily true but are instead a result of maladapted brain circuitry.

Perhaps the best-known ritual associated with OCD is that of hand washing. However, this disorder can manifest in a variety of problematic ways such as repetitive checking of ovens, doors, and locks, as well as repeating the same word, sentence, or phrase over and over (Mercadante, Rosario-Campos, Quarantini, & Sato, 2004). When experiencing OCD, hyperactivity between brain regions causes the brain to function improperly; neural pathways become stuck in the "on" position, resulting in what Schwartz and Beyette (1997) refer to as *brain lock*. A casual concern such as, "My hands are dirty," is amplified by a hyperactive brain to the point where the concern turns into an irrational fear. Subsequently, the brain becomes unable to move on to the next thought and related behavior (Schwartz & Begley, 2002). Schwartz and Gladding (2011) describe a universal phenomenon that applies to *all* false messages regardless of what causes them. A false brain message presents in the form of a thought, urge, or desire, and causes an individual to experience some kind of distress or discomfort. The distress or discomfort could be in the form of a sensation, craving, or emotional state. The goal at the point of distress or discomfort is to remove the feeling as quickly as possible—hence, the habitual, automatic, potentially unhelpful or unhealthy response. Schwartz recognizes advances in cognitive behavioral therapy (CBT) and describes the following

examples of different cognitive distortions related to CBT as being false or deceptive (Happy &

Well, 2012):

- All-or-nothing thinking

- Must be perfect with everyone and everything

- Black-and-white thinking

- Catastrophizing

- Discounting the positive (can't get over a mistake)

- Letting your emotional feelings control your thoughts

- Mind reading

- Projecting

- "Should" statements

- Comparison thinking

- False expectations

The mood and anxiety patterns that result from cognitive distortions can be problematic.

However, in the case of OCD, patients are generally aware that their compulsions and obsessions

are illogical. Schwartz (1997, 1998) developed an innovative, self-directed, plasticity-based

treatment that helps unlock links in the circuitry associated with OCD. His approach empowers

patients to "manually" shift gears in the brain allowing it to move on to the next thought and

related behavior (Doidge, 2007; Schwartz & Beyette, 1996). By manually shifting gears in the

brain, patients harness Hebb's law of plasticity which says neurons that fire together will wire

together. By not acting on their compulsions, patients unlink associations in the brain, allowing a

secondary principle to occur whereby neurons that fire apart then wire apart (Doidge, 2007).

Over time, new circuits in the brain become stronger and through the process of long-term

potentiation (LTP), old circuits weaken and prune away (Bear & Abraham; 1996; Bliss & Collingridge, 1993; Petanjek et al., 2011).

Through the use of neuroimaging, Schwartz (1997, 1998) confirmed that the brain has the ability to normalize through cognitive restructuring in patients with OCD. By attributing the urges associated with OCD to mere glitches in brain circuitry, Schwartz correspondingly introduced the revolutionary potential of the mind to self-direct changes in the brain. This supports the theory that we are not just passive bystanders of our brain chemistry. Through our own volition, we can actively focus our attention in ways that rewire the brain into adaptive patterns of our choosing (Schwartz & Begley, 2002). Hanson (n.d.) notes the intense propensity for suffering as a result of the highly evolved human brain. Only humans worry relentlessly about the future and the past. This kind of worry comprises most of our dissatisfaction and unhappiness in life, and it is created almost entirely by the brain. While the brain may be the cause of suffering, it also can be the cure; Hanson (n.d.) describes this paradox as "ironic, poignant, and supremely hopeful" (slide 47). In the next section, we shift to explore the relationship between the mind and the brain.

Mind and Brain

In this section, we first describe the two prevailing philosophies associated with the relationship between mind and brain: materialism and dualism. Then, we consider several perspectives on the interdependence between mind and brain. Lastly, we explore conscious and unconscious processes.

    Materialism and dualism. The human brain is a tangible three-pound organ containing roughly 100 billion neurons (Kandel, Schwartz, & Jessell, 2000) that we can see and feel with the human senses. The mind, on the other hand, due to its intangible nature, holds no single,

agreed-upon definition. In fact, philosophers and scientists have debated the abstract relationship between mind and brain for centuries (Leaf, 2005). The mounting evidence of mind changing brain through various cognitive strategies (Beauregard, 2007; Benazon, Ager, & Rosenberg, 2002; Schwartz, Stapp, & Beauregard, 2005), as well as the emerging science around psychoneuroimmunology and psychoneuroendocrinology, bring into question the theories that interpret the relationship between mind and matter (Leaf, 2015).

The two prevailing philosophical perspectives related to the relationship between mind and matter (brain) are materialism and dualism. The materialist viewpoint, which is becoming increasingly untenable in the realm of neuroscience (Leaf, 2015), posits that matter is all that exists. It states that everything in the universe is matter, without any true spiritual or intellectual existence. Materialism negates the idea that mind and consciousness are real and measurable, suggesting that free will and perception are the result of electrical activity in the brain (Schwartz & Begley, 2002). Materialists argue that the mind and body are not physiologically and ontologically distinct; the mind is simply an artifact that emerges from the brain (Leaf, 2005).

Dualism, proposed by French philosopher Descartes in the 17th century, asserts that the mind and body are separate from each other. This theory holds that human beings consist of a body (the brain) that is material, and a soul (the mind), which resides outside the body, that is "immaterial and indestructible" (Kandel, 2006). Doidge (2007) describes Descartes's division between mind and body as problematic because it cannot explain how the immaterial mind can influence the material brain. Descartes's view opens an "unbridgeable gap between mind and brain" (Doidge, 2007, p. 213). While many theories exist beyond and within the context of materialism and dualism, for our review of self-directed neuroplasticity (SDN), we further consider the interdependence between mind and brain.

Interdependence between mind and brain. Siegal (2012) defines the mind as a self-organizing process that controls the flow of energy and information while the brain is the embodied mechanism of that flow. What one does with their mind can change the structure of the brain (Siegel, 2011). Hanson (2011) describes the interdependence between the mind and the brain, stating, "When the brain changes, the mind changes" (p. 215). Likewise, "When the mind changes, the brain changes" (p. 215). Changes in the mind can lead to lasting change in the brain, as mental processes shape neural structure, so they are best understood as "one unified system" (Hanson, 2011 p. 216). Bingaman (2014) portrays mind and brain as bidirectional and reciprocal—representing a "two-way street" (p. 20) so to speak. When describing the difference between mind and brain, Schwartz and Gladding (2011) explain that the brain represents the passive side of an experience while the mind is active. Once it receives inputs from the environment such as images, sounds, reactions, or sensations, the brain processes the information in an automatic and conditioned way. There is no awareness or thought involved in this process; therefore, it is considered *passive*. The brain then sends the information to our conscious awareness. At this point, the mind has the ability to determine how it wants to *actively* focus on the information coming from the brain (Schwartz, 2011). The mind and brain work as a team; the brain puts out the call, the mind decides whether to listen (Allen, 2015). The mental processes of the conscious and unconscious mind influence how we hold our experiences. Therefore, we next explore the contrast between these two aspects of the mind.

Conscious and unconscious processes. Science has only recently begun to understand how conscious and unconscious processes interact. Being exceptionally difficult to measure, Kandel (2006) portrays consciousness as one of the deepest, most fascinating mysteries humans have ever tried to resolve and begs the question of whether it is ever truly solvable by science. The

major difficulty for drawing a distinction between conscious and unconscious processes is the

problem of defining each type of process (Morsella & Poehlman, 2013). Historically prominent

figures such as Freud and Jung popularized these distinctions; however, related theories have

evolved over time. Some scientists still consider the unconscious, often referred to as the

"subconscious," to be nothing more than a shadow of the conscious (Bargh & Morsella, 2008).

Ball (2019) notes the scope of prevailing views among researchers on the subject of

consciousness and describes them as ranging from "it's an illusion" to "it pervades everything"

(para. 1). Some wish to see it reduced to the fundamental biology of neurons firing; others feel

that it is an "irreducibly holistic phenomenon" (Ball, 2019, para. 2).

  Lipton (2005) explains how, over time, our brains have developed the astounding

capacity to download a mind-boggling number of behaviors and beliefs into our memory. The

fundamental behaviors, beliefs, and attitudes that we observe early in life become "hardwired as

synaptic pathways in our subconscious minds" (p. 173). Once programmed into the database of

the unconscious, they control much of our life, including our biology, unless an effort is made to

reprogram them. The conscious and unconscious minds work together interdependently. Murphy

(2008) describes this phenomenon as "two spheres of activity within one mind" (p. 17). The

unconscious mind, however, is millions of times more powerful than the conscious mind (Lipton,

2005).

  The subconscious mind can be viewed as our "autopilot," while the conscious mind is our

manual control (Lipton, 2005). The conscious part of the mind analyzes, criticizes, and considers

things logically. The unconscious part of the mind not only stores memories and controls bodily

functions such as breathing and heartbeat, it is also where wisdom, creativity and problem-

solving abilities reside (Murphy, 2008). The unconscious mind's ability to guide and inspire

from the storehouse of memory leads Murphy (2008) to assert, "The power of our subconscious is beyond all measure" (p. 37). The unconscious mind never sleeps or rests and is the source of all "ideals, aspirations, and altruistic urges" (Murphy, 2008, p. 38).

As previously mentioned, our life experiences, all downloaded into our unconscious, can be compared to a programmable "hard drive." The unconscious is habitual and only replays what it has learned from the past. In essence, the unconscious acts as one big tape recorder that *only* records. It doesn't argue, dispute, add backstory or context; it only records. It is the conscious mind that assigns meaning. As a programmed behavior unfolds, the conscious mind, using free will, can "step in, stop the behavior, and create a new response" (Lipton, 2005, p. 178). The analytical ability of the conscious mind allows it to observe habitual, conditioned responses as they are being carried out and change them (Lipton, 2005).

Self-Directed Neuroplasticity

In this section, we first provide a definition of self-directed neuroplasticity (SDN). Next, we review the features of human attention that are pertinent to SDN. Following the review of attention, we highlight the role of mindfulness. We then introduce the concepts of volition and redirection of thoughts and actions as they pertain to SDN. We conclude with an examination of consistent effort and its contribution to desired outcomes.

   Definition of self-directed neuroplasticity. The mind's ability to alter the structure of the brain through the power of thought is referred to as self-directed neuroplasticity (SDN). Schwartz and Gladding (2011) define SDN as "using the power of focused attention, along with the ability to apply commitment, hard work, and dedication, to direct your choices and actions, thereby rewiring your brain to work for you..." (p. 39). Fundamentally, SDN involves actively and intentionally using the mind to change the brain by relying on the principles of

neuroplasticity, Hebbian theory, and the quantum Zeno effect (Schwartz & Begley, 2002; Schwartz & Gladding, 2011).

The concept of a plastic brain is not new to the academic literature; however, research around SDN is still emerging. Schwartz's foundational work identifies SDN as an effective treatment for OCD (Baxter et al., 1992; O'Neill & Schwartz, 2004; Saxena, Brody, Schwartz, & Baxter, 1998; Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996; Schwartz, 1997; Schwartz, 1998). Additionally, the academic literature supports components of SDN as effective in addressing depression (Segal, Williams, & Teasdale, 2002; Teasdale et al., 2002), spider phobias (Paquette et al., 2003), and regulation of emotional response (Beauregard, Lévesque, & Bourgouin, 2001; Lévesque et al., 2003; McRae, Jacobs, Ray, John, & Gross, 2012; Ochsner, Bunge, Gross & Gabrieli, 2002; Paquette et al., 2003; Schwartz, 1997). That said, the majority of the literature currently lies within the popular press. Popular literature acknowledges the use of SDN to address a variety of additional challenges including trauma (Wimberger, 2014), overall happiness (Hanson, 2013), and false brain messages (Schwartz & Gladding, 2011). Multiple SDN approaches and techniques presently exist, with varying degrees of differentiation. Yet, all reveal the common principles of focused attention, mindful awareness, redirection of thoughts and actions, volition, and consistent effort (Hanson, 2013; Schwartz & Gladding, 2011; Wimberger, 2014). We begin our review of SDN by exploring the elements of mindful awareness and how it pertains to thoughts and actions, starting with the importance of attention.

Attention. Self-directed neuroplasticity (SDN) requires paying attention to one's involuntary thoughts, inner-dialogue, physical sensations, and actions (Schwartz & Gladding, 2011). The processes of human attention consist of three interconnected brain networks responsible for alerting, orienting, and executive control. The alerting network serves as the alarm to a potential

incoming stimulus, continually scanning the environment for something novel, such as an out-of-place sound or movement in the distance. Once the alerting network detects an incoming stimulus, the orienting network further directs attention towards the stimulus by engaging corresponding sensory networks (Posner & Rothbart, 2007), such as directing one's gaze towards commotion on the street or ears perking up at the sound of a unique bird song. The executive network, also known as executive attention, is responsible for "regulation of thought, emotion, and behavior" (Posner & Rothbard, 1998, p. 1915)—allowing one to determine what to do with this incoming information. Many false brain messages and related physical sensations emerge without intention (Schwartz & Gladding, 2011), and it is executive attention that provides the power to regulate emotional and physical responses (Rueda, Posner, & Rothbart, 2005). Without executive control, human thoughts and actions become automatic, like a reflex (Fernandez-Duque, Baird, & Posner, 2000).

False brain messages can become the default setting when they are the consistent focus of one's attention (Dispenza, 2012). The process of rewiring a default setting towards a more adaptive response engages the executive network to decide on which thoughts to focus (Hanson, 2013; Schwartz & Begley, 2002; Schwartz & Gladding, 2011; Wimberger, 2014). Schwartz and Begley (2002) explain that focused attention increases activity of the neurons recruited for that particular activity, while also quieting opposing areas of the brain. With that in mind, focused attention supports SDN in that when one focuses attention on a healthy/adaptive thought long enough to strengthen the associated neural pathways, it also prunes away the pathways associated with the unhelpful thought. Similar to when one focuses on a single conversation in a busy environment, the rest of the conversations and distractions fade away (Schwartz & Begley, 2002). Hanson (2013) describes this as "turning good mental states into good neural traits" (p.

111). Moreover, a key component to the success of rewiring the brain is mindfulness (Schwartz, Stapp, & Beauregard, 2005), a specific approach to focusing attention and awareness.

   Mindfulness. A leader in the present-day field of mindfulness, Kabat-Zinn (2012) describes mindfulness as awareness that results from "paying attention in a sustained and particular way: on purpose, in the present moment, and non-judgmentally" (p. 1). Mindfulness in an SDN practice that consists of being aware of experiencing a false brain message without paying attention to the content—for example, recognizing negative self-talk like, "I'm not good enough," and, at the same time, not believing and getting lost in the content of the thought (Schwartz & Gladding, 2011). The practice of SDN does not necessarily require a deep meditative state, or long-standing meditation practice (Schwartz & Gladding, 2012; Schwartz, Stapp, & Beauregard, 2005). However, mindfulness is often associated with a form of meditation (Williams & Kabat-Zinn, 2011), the practice of which is quickly becoming a well-developed field of research (Tang & Posner, 2012) and component of some SDN practices (Hanson, 2013; Wimberger 2014).

        A mindful meditation practice has objective effects on the circuitry of the brain (Gotnik, Meijboom, Vernooij, Smits, & Hunink, 2016; Holzel et al., 2010). Practice of mindful meditation results in decreased activation of areas of the brain responsible for processing sadness (Farb et al., 2010) and greater recruitment of areas of the brain responsible for executive control (Allen et al., 2012). Individuals coping with high amounts of stress experience decreased activations in the brain's stress pathways (Taren et al., 2015). Supporting the position of Schwartz, Stapp, and Beauregard (2005), even brief training in mindful attention exercises influences positive changes in the neural circuitry of the brain (Papies, Pronk, Keesman, & Barsalou, 2015; Westbrook et al., 2013).

Whereas fMRI research on mindful meditation is quite prevalent, studies targeting brief mindful attention interventions are emerging (LeBois et al., 2015). In a study of meditation-naïve cigarette smokers, researchers trained the participants in a brief mindfulness activity and found that mindful attention reduced activity in craving-related centers of the brain (Westbrook et al., 2013). LeBois et al. (2015) found that mindful attention to imagined stressful events increased activity to parts of the brain responsible for executive attention, among others. These neural changes correlate with participants' subjective experiences as well. Mindful attention improves self-reported indicators of wellbeing, such as reduction in anxiety (Weber & Taylor, 2016), decreased impulse to select unhealthy foods when hungry (Papies, Barsalou, & Custers, 2012; Papies, Pronk, Keesman, & Barsalou, 2015), and reduction in cravings for cigarettes (Westbrook et al., 2013). Furthermore, mindfulness can counteract negativity bias and increase optimism (Kiken & Shook, 2011).

Whether practiced as a formal meditation or simply being present and aware in the moment, mindfulness is critical to SDN (Schwartz & Begley, 2002). It is the skill that permits one to identify unhelpful thoughts as only existing within the mind, without attachment to the belief that they are true events that one must be act upon (Chambers, Gullone, & Allen, 2009). Mindful awareness of unhelpful mental events without reacting begins to breakdown maladaptive pathways (Hanson, 2013; Schwartz & Begley, 2002). Additionally, increased mindfulness practice decreases frequency of automatic, negative thoughts and creates ease of letting go of negative thoughts that do occur (Frewen, Evans, Maraj, Dozois, & Partridge, 2007). Rybak (2013) explains, "Mindfulness practice allows people to gain skills in observing their experiences more fully without having to respond in automatic ways to that awareness" (p. 117), such as recognizing the urge to eat in response to a stressful situation and realizing the capacity

to cope with that feeling of discomfort without opening the refrigerator door. Building on the principle of mindfulness, we next discuss the role of focused attention on redirecting thoughts and actions, starting with a brief review of volition as it relates to consciously redirecting thoughts and actions in beneficial ways.

    Volition. Volition, or free will, is the human capacity to decide how to act based on internal judgements, rather than an automatic response to an external stimulus or event (Haggard & Lau, 2013), such as a reflexive response (Frith, 2013; Haggard, 2008). Firth (2013) describes volition as an act "that we can choose to make (or not), deliberately and by thought alone" (p. 289). While many in the fields of neuroscience, psychology, and philosophy continue to debate the existence of human volition (Brass, Lynn, Demanet, & Rigoni, 2013), a number of studies demonstrate that humans can directly affect brain processes by choosing how to react to certain stimuli (Goldin, McRae, Ramel, & Gross, 2008; Lévesque, et al., 2003; Ochsner, Bunge, Gross, & Gabrieli, 2002; Platt et al., 2015; Schardt et al., 2009; Sripada et al., 2014; Vanderhasselt, Baeken, Van Schuerbeek, Luypaert, & De Raedt, 2012). As such, volition plays a vital role in the process of SDN because it allows individuals the innate ability to change their brain circuitry (Chancellor-Freeland, 2006; O'Neill & Schwartz, 2004; Schwartz & Begley, 2002; Schwartz, Stapp, & Beauregard, 2005). Volition empowers humans with the realization that there is freedom to choose how to react to false brain messages and maladaptive reactions (Schwartz & Gladding, 2011). Moreover, volition allows for the capacity to recognize that a more adaptive response is possible, providing the ability to take corrective action to override automatic maladaptive responses (Pierson & Trout, 2017), which leads to the SDN principle of redirection of thoughts and actions.

Redirection. Reappraisal is "the cognitive transformation of emotional experience" (Ochsner, Bunge Gross, & Gabrieli, 2002, p. 1215), in other words, redirecting one's thoughts. Humans cannot choose which thoughts and feelings emerge into consciousness yet do have the capacity to decide which thoughts hold attention (Pierson & Trout, 2017), how to react, and what meaning to assign (Schwartz & Gladding, 2011). Reappraisal techniques vary and include intentionally reframing the meaning behind an experience (McRae, Jacobs, Ray, John, & Gross, 2012), or observing in a detached and objective manner (Goldin, McRae, Ramel, & Gross, 2008; Lévesque, et al., 2003). This can be as simple as redirecting a thought like a strong craving for a specific food. Instead of acting on the craving, one could objecticity say, "That's just my brain talking. I don't need to eat that candy bar."

Through effortful and intentional engagement in reappraisal strategies, humans not only experience subjective differences in emotion (McRae, Jacobs, Ray, John, & Gross, 2012; Platt et al., 2015); these acts of transforming mental representations have a direct effect on the neural pathways of the brain (Schwartz, Stapp, & Beauregard, 2005). Employing reappraisal techniques increases activity in the prefrontal cortex and decreases activity in the amygdala in the setting of emotionally upsetting material (Goldin, McRae, Ramel, & Gross, 2008; Ochsner, Bunge, Gross, & Gabrieli, 2002; Vanderhasselt, Baeken, Van Schuerbeek, Luypaert, & De Raedt, 2012). Reappraisal also increases interconnectivity of various regions of the brain responsible for emotional regulation (Platt et al., 2015). Even participants genetically predisposed to an overactive amygdala are able to willfully decrease activity in this area of the brain by engaging in reappraisal strategies (Schardt et al., 2010). Furthermore, we review how redirecting physical actions contributes to an SDN practice.

Concentrating on constructive actions rather than maladaptive default reactions is another key component of SDN. At times, false brain messages can lead to unhealthy coping behaviors such as substance use and overeating (Schwartz & Begley, 2002; Schwartz & Gladding, 2011). As discussed earlier, the first step is mindful awareness of these thoughts and related actions, followed by effortful reframing of the experience or meaning of them. Then, through willfully choosing a constructive substitute for the default action, one creates and strengthens new neural pathways that cement the more desirable reaction as the default, while simultaneously weakening maladaptive pathways (Schwartz & Gladding, 2011). "The goal is not to try to distract yourself, but to engage your attention in a constructive activity so that your brain rewires in a healthy, adaptive way..." (Schwartz & Gladding, 2011, p. 249). For example, when the urge to smoke a cigarette or overeat hits, instead of succumbing to the urge, one partakes in another activity such as going for a run, reading a book, or doing a favorite hobby (Schwartz & Gladding, 2011). Self-directed neuroplasticity is not a once-and-done approach. Instead, one must consistently employ these strategies to create lasting changes (Schwartz & Begley, 2002).

Consistent effort. As stated earlier, Hebbian theory dictates that neurons that fire together wire together, and the more frequently these neurons fire together, the stronger the neural pathways become (Hebb, 1949). In conjunction with Hebbian theory, the quantum Zeno effect relies on focused attention to hold these pathways in place long enough for Hebb's law to take hold and cement the pathway (Chancellor-Freeland, 2006; Schwartz & Gladding, 2011; Schwartz, Stapp, & Beauregard, 2005). The quantum Zeno effect refers to the phenomenon in quantum physics whereby sustained observation or focused attention on a certain state holds the status quo of that condition, even if probability dictates a change in said condition; essentially, the observer's attention has a direct effect on the outcome by freezing it in place longer than

classical physics dictates as possible (Stapp, 1999; Schwartz, Stapp, & Beauregard, 2005). In the context of SDN, when a person willfully sustains specific thoughts, the quantum Zeno effect, in combination with Hebb's theory, stabilizes neural pathways long enough to create new pathways or strengthen existing pathways (Chancellor-Freeland, 2006; Schwartz & Gladding, 2011). Following this logic, the more consistently and frequently one engages in SDN strategies using mindful awareness, focused attention, and intentional redirecting of thoughts and actions, the more automatic these beneficial reactions become (Schwartz & Begley, 2002; Schwartz & Gladding, 2011). For example, study participants who reported higher frequency of utilizing reappraisal showed greater ability to employ reappraisal techniques and subsequently reported greater overall wellbeing (McRae, Jacobs, Ray, John, & Gross, 2012).

The brain's malleability enables individuals to proactively change persistent behaviors and cultivate new neural pathways. Yet, changing years of automatic behavior is not easy (Schwartz & Gladding, 2011). Resistance is common, particularly when a person experiences a significant change, and even more so, when one occurs too quickly. Whether or not the individual desires the specific change is irrelevant (Mahoney, 2004). In seeking to conserve energy, the brain resists the formation of new neuronal connections in order to retain its current state (Allen & Schwartz, 2007). For example, when introduced to new information, the amygdala prompts alarms and associated challenges as this part of the brain tries to fortify existing behaviors and underlying knowledge (Read, 2007). Schwartz and Gladding (2011) emphasize, "You have to expend the effort and energy to recruit different brain pathways and make different choices each time you are confronted with the urge to follow your old ways" (pp. 25-26).

Summary and Research Question

Neuroplasticity refers to the brain's ability to change and adapt both structure and function in response to different sensory experiences (Voss, Thomas, Cisneros-Franco, & de Villers-Sidani, 2017). Previously considered "fixed" beyond early development, we now know that changes in brain function and structure occur throughout the lifespan (Bach-y-Rita, 1972; Eriksson et al., 1998; Jenkins, Merzenich, Ochs, Allard, & Guic-Robles, 1990). The ability to make new neural connections, or "rewire," based on any stimulus, thought, or experience (Doidge, 2007) happens with or without our awareness (Trojan & Pokorny, 1999). As such, self-directed neuroplasticity specifically addresses our capacity to proactively change cerebral function through volitional control (Schwartz & Begley, 2002; Schwartz, Stapp, & Beauregard, 2005) and the intentional practice of focusing attention in desired ways (Schwartz & Begley, 2002). In other words, the mind can consciously change the brain (Begley, 2008; Hanson & Mendius, 2009; Schwartz & Gladding, 2011). Self-directed neuroplasticity approaches are successfully used to treat a range of challenges, including obsessive compulsive disorder (OCD) (Benazon, Ager, & Rosenberg, 2002; O'Neill & Schwartz, 2004; Schwartz, 1997), depression (Segal, Williams, & Teasdale, 2002; Teasdale et al., 2002), spider phobias (Paquette et al., 2003), and regulation of emotional response (Beauregard, Lévesque, & Bourgouin, 2001; Lévesque et al., 2003; McRae, Jacobs, Ray, John, & Gross, 2012; Ochsner, Bunge, Gross & Gabrieli, 2002; Paquette et al., 2003; Schwartz, 1997). However, no research exists that describes the lived experience of individuals practicing self-directed neuroplasticity across multiple modalities. Therefore, the purpose of this research project is to describe the lived experience of individuals practicing self-directed neuroplasticity.

Research Lenses

The purpose of this chapter is to articulate the relevant research lenses that influenced the development and implementation of this study. While not always specifically noted in many published studies, we recognize how critically important this articulation is given the changing landscape of research: multiple epistemologies, axiologies, and cultures of inquiry, not to mention multiple methods of data collection and types of data collected. When researchers do not specify their underlying assumptions, readers can only speculate as to how these assumptions may have influenced the design of the study, data collection, data analysis, and conclusions drawn by the researchers. When researchers are transparent about these assumptions, however, they encourage their readers to think more critically about how these assumptions impact *any* type of research. Moreover, researchers who do this, make it possible for readers to hold them accountable to the *researcher's standards*, rather than artificially impose other standards (which may or may not be relevant). Thus, in light of this full disclosure, a reader may more accurately assess the reliability and validity of this study's findings.

First, we elaborate on how our research paradigms and culture of inquiry frame this research project. Next, we describe the theoretical lenses guiding our study and how they influenced the development of this project. We follow this description by articulating our relevant personal and professional lenses and how they have impacted this study.

Research Paradigm and Culture of Inquiry

Guba and Lincoln (1994) suggest a paradigm "represents a worldview that defines, for its holder, the nature of the 'world,' the individual's place in it, and the range of possible relationships to that world and its parts…" (p. 107). As an orienting element of research design, a paradigm helps sharpen researcher focus for expanded learning, contextualizes deeper

understanding of the world, and informs new-learning relevance for both self and others (Rallis & Rossman, 2012). At the outset of our project, we collectively found our perception of reality to be rooted in the critical paradigm. However, soon after initiating our research design, we became aware that the constructivist paradigm also influenced our conceptual framework. Two of our team's researchers found this paradigm to be particularly influential during our project design, implementation, and interpretation stages and detail their perspectives within their respective personal lenses.

Framed in subjectivism rather than empiricism (Rallis & Rossman, 2012), the critical paradigm provides guiding context to qualitative research in which the dialogue and diverse experiences are valued elements of the process (Guba & Lincoln, 1994). Anchored in an ontology whereby the "reality" of nature may only be viewed from a value lens (Guba, 1990), researchers operating within this paradigm seek to understand deeply and free of hypothesis— typically leveraging methods to discover and eliminate false consciousness. The critical paradigm possesses a number of strengths, including its ability through dialogic immersion to self-empower research participants—i.e., "not about me without me." Furthermore, the paradigm can facilitate positive social change while communicating the depth and complexity of unique stories. Finally, its incorporation of methods that discover and eliminate false consciousness can invigorate and promote transformation (Guba & Lincoln, 1994).

The constructivist paradigm also is epistemologically subjectivist, yet broader in this assumption. Researchers create knowledge via the investigator-respondent interaction, whereby the investigator and the object of investigation are actively interconnected. Consequently, researchers simultaneously generate findings during the actual investigative process (Guba & Lincoln, 1994). Within the paradigm's relativist ontology, "realities" exist within people's

minds. Shaped by location and personal experience, researchers can apply a number of interpretations, or mental constructions to every inquiry. Rather than being seen in an absolute sense as being more or less true, these constructions are instead viewed as being more or less sophisticated and/or informed, as well as alterable (Guba & Lincoln, 1994).

Given our paradigms' subjective epistemologies; relativist ontologies; and lived experience, deconstructionist, and multiple-reality axiologies; we concluded phenomenology was the most appropriate culture of inquiry to ground our research design. A dearth in recognized understanding of the lived experience of individuals using self-directed neuroplasticity, as well as seemingly nothing similar from which we could make valid suppositions (Bentz & Shapiro, 1998), further validated our conclusion. As stated by Lichtman (2014), "The purpose of phenomenology is to describe and understand the essence of lived experiences of individuals who have experienced a particular phenomenon" (p. 111). With a core tenant of understanding phenomena in its own terms, phenomenology allowed us to most directly gain knowledge regarding people's thoughts and feelings (Bentz & Shapiro, 1998). Through this meaning-giving method of inquiry (van Manen, 2016), we also could be co-creators of new knowledge with our research participants. More specifically, how we designed this study reflects on these principles. For example, they largely influenced our selection of the interview method for data collection. In addition, we had greater opportunity to obtain deep, meaningful data associated with the phenomenon through each study participant's own words (Brinkmann, 2013; Creswell, 2014; Lichtman, 2014). The philosophical principles of phenomenology also shaped our approach to collecting data, including the application of bracketing (i.e., suspending personal judgment in order to fully analyze the experience), engaged listening, and empathetic immersion throughout the process to promote deeper understanding. As a result, we became co-creators of each

transcribed narrative (Bentz & Shapiro, 1998). Phenomenological principles further influenced our selection of thematic analysis for analyzing study participant data. Closely aligned with phenomenology through its subjective emphasis on the human experience (Guest, MacQueen, & Namey, 2012) and more fully described in our Method chapter, thematic analysis highlights the experience, including related thoughts and perceptions, of each participant as the study's key component. Seeking greater understanding via deconstruction and reconstruction, we also continued to engage in bracketing throughout data analysis to examine and consciously suspend existing beliefs, as well to initiate empathetic immersion, slow our pace to consciously dwell, magnify and amplify, and apply intense interest (Bentz & Shapiro, 1998). In addition to our paradigms and culture of inquiry, two theoretical frameworks influenced the design, implementation, and interpretation of our study.

Theoretical Lenses

Two complementary theoretical frameworks provide the necessary conceptual grounding for this study. They are Hebbian theory, and transformative learning theory. We summarize each theory and make specific connections to this particular research project.

Hebbian theory. Hebb (1949) theorized that the more frequently one neuron triggers the firing of another neuron, the more efficient, or cemented this pathway, or circuit, becomes. Stronger neuronal circuits due to repetitive firing between neurons leads to more habituated, or automatic, thoughts or actions associated with those pathways. Hebb explains the theory as the basis for all learning. It also explains how unhelpful behaviors or false brain messages become habit and why humans can alter brain structure by redirecting thoughts (Schwartz & Gladding, 2012). Our understanding of Hebbian theory created a foundational knowledge of neuroplasticity that ultimately contributed to our definition of SDN, as well as identification of appropriate study

participants. Furthermore, Hebb's theory helped frame the development of the open-ended

questions for our interview process, and ultimately, the analysis and interpretation of our results.

For example, when critically reflecting on the possible reasons for our results, we clearly

identified Hebbian theory in participants' descriptive context of practice indicating SDN became

easier with practice. The more frequently participants practice SDN, the stronger the associated

pathways, which leads to a more automatic or "easier" response. In addition to Hebbian theory,

transformative learning theory influenced our project.

Transformative learning theory. As summarized by O'Sullivan (2003), "Transformative

learning involves experiencing a deep, structural shift in the basic premises of thoughts, feelings,

and actions" (p. 327). The humanist and constructivist assumptions fostered by Mezirow's

(1978) theory of transformative, or transformational, learning closely align with the critical and

constructivist paradigms that shape this research project. One of the core concepts of

transformative adult learning is experience. Experience, especially past experience, provides the

basis for habitual expectations that create the lens from which learners "perceive, interpret, and

make meaning of their world" (Taylor & Cranton, 2013, p. 35). Previous experience is also a

primary vehicle of transformation. Mezirow (1996) asserts, "Learning is understood as the

process of using a prior interpretation to construe a new or revised interpretation of the meaning

of one's experience in order to guide future action" (p. 162). This concept aligns with and honors

our choice of a phenomenological interview method, as well as our design of open-ended

interview questions. As researchers, we recognize that "learners examine their worldview in light

of their own particular belief or value system…" (Merriam, 2004, p. 116).

Mezirow (1991) emphasizes development, or change over time, as being at the heart of

transformative learning. Merriam (2004) maintains that to engage in the process of development,

especially development that leads to more mature levels of thinking, a certain degree of cognitive functioning is required. This argument centers on the components of critical reflection and reflective discourse, two processes integral to the facilitation of transformative learning and evident in the experiences and motivations of our participants. Critical reflection on individual thoughts and actions, as well as consideration of different perspectives, are fundamental to the process of SDN. Mezirow (1985) expanded his initial theory to view perspective transformation by relating the process to self-directed learning, which includes the *instrumental* aspects of how to best learn the information, the *dialogic* facets of when and where the learning best takes place, and the *self-reflective* process of why the information should be learned (Merriam, 2004). Our participant interviews echoed these aspects of Mezirow's theory through the sharing of experiences.

It is important to note that we discovered Mezirow's theory after completing the data analysis phase of our project. While we were unacquainted with the theory prior to this stage of development, we acknowledge that during that time, we were operating intuitively within the theory without being consciously aware of it. As we became more familiar with the theory, it played a more predominant role in framing how we interpreted our results and discerned subsequent implications.

Personal and Professional Lenses

As Patton (2000) notes, the researchers *themselves* are important instruments of data collection and analysis. Just as our professional experiences have given us lenses that are relevant in terms of our credibility as research instruments in this study (Patton, 2000), each of us has relevant personal experiences that contribute to how we *see* this topic, how we engage with it

as researchers, and how we use ourselves in the research process. Therefore, we describe our experiences and how we use them throughout the research process.

   Tim Klein. For many years, I operated within the predominate post-positivist paradigm of the corporate world. More specifically, as a marketing professional often involved with quantitative studies, I was taught by various mentors and instructors to approach research from an unbiased lens of factual discernment. Order, prediction, and control were of paramount importance. Yet, with each individual seemingly interjecting their own values within this discernment process, I frequently questioned how achievement of objectivity actually was possible. This question frequently surfaced as I became more involved in executing qualitative interviews and focus groups. From my perspective, every individual determines what reality is and how it works through a lens of personally assigned values. In other words, I believe how we know what we know is subjective. To me, values clearly play an integral role in any research initiative. In possessing this criticalist axiology, I am energized by what I believe is research's inherent opportunity to transform and empower, particularly with respect to community action, social activism, and social consciousness. Consequently, this paradigm played a significant role in how I viewed the grounding of this project. From nearly the start, through my subjectivist nature and the inherent value I place on each individual's lived experience, I leaned toward leveraging a phenomenological approach for our research design. Moreover, with its emphasis on the importance of dialogue and diversity in experiences, this paradigmatic perspective guided my collaborative vote for the interview method in order to help us more deeply understand those things our research team likely would be unable to directly observe.

   Fueled in large part by my critical paradigm, my marketing career further influenced how I approached each stage of this project. With prior experience in conducting marketing research,

I recognize the importance—as well as strengths and weaknesses—of various quantitative and qualitative methods used to collect, analyze, and interpret data. However, I frequently found that qualitative data gathered through focus groups or one-on-one interviews typically provided richer, deeper, and more meaningful context to our inquires. Clearly, this perspective influenced development of our interview guide, and more specifically, the creation of our demographic and semi-structured, open-ended questions. Moreover, my prior experience in conducting interviews and focus groups helped cultivate my perspective regarding how to effectively interview our study participants: from a space of comfort and trust, as well as engaging as authentic, active, and empathetic listeners. Finally, this experience instilled in me a belief in the importance of recognizing and claiming my biases—before even designing research questions, through data collection and analysis, and into the interpretation of findings. As a result, I viewed proactive suspension of personal judgement and ongoing reflection throughout every phase of our research process as essential to the success of our project.

In addition to my professional experiences, several key personal experiences further shaped the lenses I applied to every aspect of this research project. First, growing up in a rural, conservative family and area, some might assume my exposure to and embrace of the mind's ability to facilitate healing came later in life. However, looking back, I believe both began to occur at a very early age. For example, prior to starting elementary school, my parents and Sunday-school teachers introduced me to the healing power of daily prayer. In fact, I can vividly recall discussions from as far back as kindergarten. By the time I was a teenager, my mom was recommending (in addition to prayer), "Just meditate on it, and you'll feel better," as a way to address stress or emotional regulation. Although none of us would have recognized the words neuroplasticity or self-directed neuroplasticity (SDN) those many years ago, I believe each

example represents, in part, the use of the mind to direct or re-direct the brain in adaptive ways for greater health and wellbeing. Second, an increasingly debilitating chronic health challenge I experienced approximately 10 years ago prompted me to explore treatment interventions beyond those offered via allopathic medicine. Within the holistic path I eventually pursued, my functional doctor and coach introduced me to several tools geared to enhance overall healing through proactive mind-brain interactions. In fact, during this time, I actually first heard the term "brain rewiring" during sessions with my functional doctor and coach. They believed it was important for the mind to play a more active role in guiding the brain—including continually elevating awareness and redirecting thoughts when necessary—in order to achieve optimal mind-body-spirit balance. Although integrating these modalities into my healing regimen initially seemed foreign, it also intuitively made sense. Ultimately, I found proof in results, as I believe these tools played a significant role in supporting my eventual recovery. Third, and buoyed by regaining my health, my interest regarding the power of adaptive mind-brain interactions continued to grow. My attention peaked whenever conversations even remotely veered into the subject, when running across related content in the popular press, or actively searching the internet for additional information. My immersion into neuroplasticity and self-directed neuroplasticity significantly escalated—including a much deeper dive into both academic literature and the popular press—when I serendipitously was aligned nearly two years ago with two extremely talented and intelligent research partners who also hold passion for this topic. This deep immersion into what was already known about SDN, my lived experience with SDN, and my exposure to my research partners' lived experiences with SDN undoubtedly helped further frame both how I came to this research project and, very importantly, how I viewed each aspect of its design, implementation, and interpretation.

Beth. My personal and professional lenses intersect with how I participated in this research project. I disclose my lenses with the intention that it provides the reader an opportunity to understand how my experiences influenced the conceptualization, design, implementation, and interpretation of this project.

The passion I have for this project stems from a transformational journey through illness. Troubling symptoms for over a decade precipitated a complete decline in my health and I was faced with the daunting task of figuring out how to get my life back. Our medical system, brilliant in terms of providing symptom relief, yielded little in the way of sustainable answers. For years, marginally existing on multiple medications, I continued my quest for wellness. This search led me to dozens of gifted healers and practitioners in a variety of healing arts. Although helpful in small ways, I remained relatively dysfunctional. Finally, after starting a wildly alternative treatment, my health began to improve, and I set out to find the remaining pieces to my complex healing puzzle. The most instrumental piece of that puzzle—and the discovery that inspired enduring change in my life—came in the form of self-directed neuroplasticity.

Illness factored into my epistemological development and played a critical role in my desire to promote social change, yet, my personal ontology aligns most closely with that of constructivism. My parents, curious about the metaphysical and open to spiritual cultivation, helped shape this worldview early in life. Subjectivity and differing points of view were valued in my household, and I was encouraged to think critically about my experiences. Scientific facts, while greatly appreciated and frequently useful, are not always necessary for me to form an interpretation. When making major life decisions, I often balance anecdotal evidence with scientific data.

I am mindful of biases resulting from my personal experience with self-directed neuroplasticity and remained cognizant during all phases of our project that my experience is unique to me. This knowledge tempered my propensity to view self-directed neuroplasticity through a generally positive lens. Not everyone achieves or even desires the results I experienced, and I recognize that neuronal rewiring is based on many factors such as age, condition, and motivation.

The methodology of our study appealed to my relativist nature because it explored the essence of a phenomenon through the unique lenses of the individuals experiencing it. My philosophical belief that the sharing of experiences is a reciprocal, communicative process between participant and researcher informed the use of in-depth, semi-structured interviews as our method of data collection. Often, throughout the course of recruitment discussions, I advocated for a diverse representation of experiences as my constructivist paradigm embraces many interpretations of reality. Despite best efforts to remain mindful of biases, I am aware that my personal use of several self-directed neuroplasticity tools and modalities likely influenced my interpretation of this project in ways of which I was not always conscious.

My professional work in the world also influenced my participation in this project. As a flight attendant for 29 years, I've traveled to several areas of the world. These travels, while exciting and eye-opening, both test me and teach me. Learning to learn through immersion in different cultures pushes me outside my comfort zone and helps me recognize the subjective nature of our experiences. As a teenager and young adult, I danced professionally with several ballet companies. This career, interpretive in nature, explores, from many different angles, the exquisite relationship between movement and music. Ballet resonates with my personal views on research because it marries the quantitative and the qualitative; technique, while important,

conveys little without personal expression. I also enjoyed a meaningful calling in photography. My current career goals encompass the framework of holistic health, the mind-body connection, and nutrition. I completed my education from The Nutritional Therapy Association in 2017, and from that learning, developed a deep appreciation for the power of food in health. As a Nutritional Therapy Practitioner (NTP) and mind-body wellness coach, I plan to help people nourish their bodies and examine the intimate connection between the mind and body. Correspondingly, the axiological beliefs I hold around balance and fairness, reciprocity, community rapport, and social justice helped form the basis for my approach to this project.

Theresa. I have worked as a registered nurse for 11 years. I spent my undergraduate education learning about nursing diagnoses, treatment plans, and the properties and effectiveness of specific medications. While many nursing programs encourage a holistic approach to patient care, my experience was one that implied healing could happen only under the care of medical professionals. We treat the whole patient, as long as that treatment fits within what allopathic practitioners can offer and insurance will cover—implying that healing happens only if the patient is compliant with the recommendations of the experts. However, my professional experience has taught me something quite different. In over a decade of patient care, I have seen patients recover even when neglecting to follow medical advice. Conversely, I have seen those who have followed recommendations to the letter fail to make progress. Interestingly, in many of these cases, it seems mindset and expectations played a much larger role in healing (or not) than the actual treatment plan. Through these experiences, I began to wonder to what extent a person's thoughts, actions, and experiences influence healing. This curiosity stemming from my professional experiences contributed to the development, implementation, and interpretation of this project.

My undergraduate and professional experience initially created an internal paradigm conflict. Healthcare is firmly planted in an evidence-based, positivist paradigm and is the world in which I have spent much of my time over the past 15 years. When I started the research sequence, I knew I was not a member of the positivist paradigm and approached the first semester as a post-positivist. However, after some major life events and a healthy dose of self-reflection and these professional experiences, I realized I was more comfortable in the critical and constructivist paradigms. Within these paradigms, reality is subjective. In my mind, the best way to learn about someone's reality is through hearing their story—a story that may provide insight into this professional conundrum which influenced my desire for a phenomenological approach and interview method.

Furthermore, many of my personal experiences contributed to the conceptualization of this project. I grew up in a family whose motto is "God helps those who help themselves." As a result, I come from a long line of do-it-yourselfers. My dad built or significantly remodeled every home we lived in as a family, and my mom sewed many of my clothes. I have taken this principle of doing for myself into my own adult life. I grow a lot of my own food, make my own soap, bake bread from scratch, and sew many of my own clothes (when I'm not knee-deep in research). For me, self-directed neuroplasticity falls into this idea of doing for yourself. I am fascinated by the possibilities and application in my own life and how others have harnessed its potential. Furthermore, my do-it-yourself attitude contributed to advocating for a slightly more hands-on approach to the transcription process and my desire to analyze data by hand, rather than using computer software. It was difficult to think about outsourcing any piece of the project.

As I was pulling additional articles for our final review of the literature review, I realized I was searching for more studies like the one we designed. Quantitative research, statistics, and

numbers hold a valuable place in research, but I was looking for more. Numbers don't always tell the whole story. I wanted to learn about the people behind the numbers and what meaning their experiences held for them. Phenomenological inquiry and thematic analysis allowed us to dig deeper and ask the questions to which we wanted the answers. From this vantage point, we were able to hear directly from our participants about their experiences, including life-changing personal transformation.

Finally, many of the decisions regarding project design, implementation, and interpretation result from me being a novice researcher. This is the first time I have ever been involved in the decision-making process for a project of this magnitude. While I did my best to immerse myself in learning and to think critically about the entire project, without the experience of ever doing this before, some decisions were a leap of faith. Even after completing the first interview and journaling reflections, I recognized processes we could have done differently or eliminated. I didn't know what I didn't know; but then again, maybe research ignorance was bliss.

Method

The purpose of this chapter is to describe how we used a phenomenological approach to answer our research question: *What is the lived experience of individuals practicing self-directed neuroplasticity?* First, we discuss our research design rationale, including our guiding critical and constructivist paradigms, culture of inquiry, and interview method. We then outline our sampling procedures and identify data sources. Next, we detail our instrumentation, followed by our data collection and data analysis procedures. We follow with an overview of the rigor demonstrated in our research process. We then highlight ethical considerations regarding protection of human subjects participating in this study. Finally, we conclude the chapter by providing an overview of the limitations associated with our research design.

Rationale for Research Design

Our critical and constructivist paradigms, as well as our phenomenological culture of inquiry, ground the design of our research project. Within this framework we chose the interview method to understand individual perspectives and possible themes regarding the phenomenon of individuals' lived experiences using self-directed neuroplasticity (SDN). Below, we detail the framing of our research design.

Rationale for the critical and constructivist paradigms. Both the critical and constructivist paradigms guided our project. Each paradigm is epistemologically subjectivist in nature, recognizing that we obtain the known or knowable via our personal experiences (Bentz & Shapiro, 1998; Guba, 1990). The critical paradigm was appropriate for this research project because it gives meaning and utility to the lived experience of our participants while facilitating our ability to obtain deeper understanding, unencumbered by the researchers' hypothesis. Operating within this paradigm, values influence the research and, as such, the critical paradigm

serves as a strong catalyst to fuel our desire to increase consciousness and transformation regarding the topic of self-directed neuroplasticity (Bentz & Shapiro, 1998; Guba, 1990; Guba & Lincoln, 1994).

Within the constructivist paradigm, one cannot separate the knower from the known, therefore, "findings are literally the creation of the process of the interaction of the two" (Guba, 1990, p.27). What's more, one accumulates knowledge only in a relative sense through a hermeneutic and dialectic methodology that educes, sharpens, contrasts, and compares individual constructions to ultimately arrive at new interpretations that are increasingly informed or sophisticated (Guba & Lincoln, 1994). Given its relativist ontology and an axiology that emphasizes the deconstruction of assumptions, consideration of multiple realities, and paradox, we believe the constructivist paradigm had a stronger influence our research project. Within this context, any inquiry may be subject to a multitude of interpretations because individual realities exist in each person's mind. Therefore, one can view everything as relative. The constructivist paradigm supports our search for better-informed, as well as increasingly sophisticated, constructions of the lived experience of self-directed neuroplasticity (Guba, 1990).

We recognize that both of these paradigms present limitations. In contrast to the positivist and post-positivist paradigms, neither the critical nor the constructivist paradigm relies on order, prediction, or control. Therefore, no objectifiable, comparative results are available (Guba & Lincoln, 1994). We cannot generalize our results both because we did not intend to do so within the context of our paradigms and because we did not randomly select our participants (Guba & Lincoln,1994). Furthermore, because the nuances of language and meaning are subjective, consistent interpretation of meaning from one individual to the next can create challenges (Guba & Lincoln,1994). Finally, with the underlying paradigmatic beliefs that "we are all

interconnected," we are unable to detach from what we know. This lack of detachment could have influenced the research, with findings ultimately being value mediated (Guba & Lincoln,1994). We detail additional perspective about our critical and constructivist paradigms in the Lenses chapter of this paper.

   Rationale for phenomenology as our culture of inquiry. Focusing on what transpires within an individual (Creswell, 2014), phenomenology describes and facilitates understanding of the experiential, lived meaning of a particular phenomenon (Lichtman, 2014). Originating from the disciplines of psychology and philosophy, this culture of inquiry supports, in the most direct manner, researchers' learning about how individuals think and feel. Helping to create a holistic research picture (Creswell, 2014), phenomenology importantly and strongly connects with the lived experience and deconstructionist, multiple-reality axiologies of our critical and constructivist paradigms. Consequently, it was best suited for this project, as it provided us the ability to capture relevant perspectives and, ultimately, the essence of study participants' lived experiences (Creswell, 2014; Lichtman, 2014; Merriam, 2009). As a meaning-giving method of inquiry (van Manen, 2016), phenomenology offered us the opportunity to be co-creators with study participants in generating new knowledge by bringing voice to their lived experiences of SDN. Furthermore, this culture of inquiry assisted us in establishing a corresponding research method that we could use to fully describe a person's lived experience regarding an event or situation—in this case, the lived experience of practicing SDN.

   At its core, phenomenology informs understanding of a phenomena in each individual's own terms—providing a description of human experience as it actually is experienced by the individual (Bentz & Shapiro, 1998) and allowing the essence of that experience to emerge (Cameron, Schafer, & Park, 2001). This learning is free from as many of the societal and

intellectual constructs as possible (Bentz & Shapiro, 1998). Moreover, this culture of inquiry

stresses that only those who have experienced lived phenomena can communicate them to the

outside world (Center for Innovation in Research and Teaching, 2018). Finally, phenomenology

provides a deeper understanding of the lived experience while striving to ascertain the

universality of an experience**.** With themes and related meanings of experiences generated from

the data (Bentz & Shapiro, 1998), this culture of inquiry may facilitate the establishment of new

theories, as well as policy and/or response to change (Center for Innovation in Research and

Teaching, 2018). The results we obtained through a phenomenological approach may help

surface misconceptions regarding a specific experience. Participants may then more forcefully

assert their thoughts and experiences, potentially prompting action or, at a minimum, greater

opportunity to challenge existing beliefs/ideas and satisfaction with the status quo (Center for

Innovation in Research and Teaching, 2018).

While we believe phenomenology was best suited for our project, we recognize the

associated limitations. Phenomenological research requires that each participant have the ability

to articulate their respective thoughts and feelings regarding their particular experience. When

considering phenomenological reduction, additional questions arise regarding the potential

stripping away of essential context (Butler-Kisber, 2018). Furthermore, phenomenology relies on

researcher interpretation. Although researcher bias is extremely challenging to perceive or verify,

phenomenological reduction is crucial in order to diminish any biases, predetermined notions, or

expectations about the phenomenon. Due to the subjectivity of the data, it may be more difficult

but not impossible, to establish reliability and validity for this research (Center for Innovation in

Research and Teaching, 2018). Finally, consistent with the critical and constructivist paradigms,

researchers operating within this worldview do not seek generalizability as the desired outcome (Center for Innovation in Research and Teaching, 2018).

Rationale for the interview method. Within the framework of phenomenological research, considerable qualitative data collection occurs through interviews (Merriam, 2009). As Patton (2002) states, "We interview people to find out from them those things we cannot directly observe" (p. 340). Typically framed within a descriptive context, and often relying on deeply personal conversations, these in-depth interviews facilitate understanding of individual perspectives via one-on-one conversations regarding a specific phenomenon.

We chose the interview method for this research project, focusing on an individual, face-to-face or virtual, in-depth, semi-structured, open-ended, and responsive approach (Brinkmann, 2013; Creswell, 2014; Merriam, 2009; Lichtman, 2014). In contrast to a quantitative, survey-based approach, the interview method provided us greater opportunity to obtain deep, meaningful data associated with each study participant's own words (Brinkmann, 2013; Creswell, 2014; Lichtman, 2014). Additionally, Kvale and Brinkmann (2009) ascertain that "The live interview situation, with the interviewee's voice and facial and bodily expression accompanying the statements, provide richer access to the subjects' meaning than the transcribed texts will do later on" (p. 129). Finally, consistent with our culture of inquiry, we were able to design and ask questions that solicit information of highest interest regarding the lived experiences of individuals engaged in SDN and their associated meaning.

Given our research paradigms and phenomenological culture of inquiry, the flexibility and reflexivity integrated within the interview method was critical for our research project because it enabled free-flowing emergence of study participant thoughts without the constraints of preconceived notions of us as researchers (Brinkmann, 2013; Creswell, 2014; Rubin & Rubin,

2012). Reflexivity encompasses each researcher's reflections regarding her/his unique role in

the study, as well as personal history, experience, culture, etc. that could potentially influence

respective interpretations (Creswell, 2014). We reference specific information regarding

respective researcher reflexivity in the Lenses chapter.

The interview method benefits research situations such as ours whereby we cannot

directly observe participants practicing SDN. However, even if we could, we would not have

been able to observe the results of the practice directly; therefore, we relied on descriptions from

participants. When implementing the interview method, the interviewing researcher has control

over the line of questions posed (Creswell, 2014). In contrast to surveys, which only allow for a

specific response, this method provides researchers the opportunity to gather spontaneous

responses. Moreover, when in a one-on-one interaction with a researcher during the interview,

the study participant may feel more open and comfortable responding to potentially personal

questions (Bentz & Shapiro, 1998). Finally, the interview method enables participants the

freedom and space to convey historical information, thereby potentiating a more robust context

(Creswell, 2014).

While the interview method was most appropriate for our project, we recognize its

limitations. Participants provide information that is indirect and filtered through their own lenses.

In addition, contextual questions emerge as to whether participants truly experience the same

phenomena, recognizing that each context, regardless of the similarities, is uniquely individual in

nature. Moreover, words are limiting, especially with hard to define topics such as SDN. A

researcher's presence during the interview process may contribute to response bias, not all

people are equally articulate and perceptive, and interviews generate data in a designated

location in lieu of a natural field setting (Creswell, 2014). Having an additional researcher in the

room taking notes also could have been uncomfortable for some participants. To mitigate this risk, we dedicated several hours of discussion to nurturing an interview environment conducive to the sharing of our participants' personal experiences. Researchers also built rapport by introducing themselves prior the interview and answering questions together. For those interviews conducted by video technology, we acknowledge that researchers may not have been able to gain as much rapport or trust with the study participants. Furthermore, observations of non-verbal communication can be subjective, and experiences both aligned and differed in various ways among the three researchers in the project. Although interviews may provide deep, meaningful data regarding perceptions of individuals who have experienced the phenomenon, each researcher must exercise caution—employing reflexivity and bracketing—to protect against projecting meaning on the content generated, as well as the interpretation (Creswell, 2014). Finally, interviews are time intensive, requiring allocations to one-on-one time with participants and for subsequent transcription (Bentz & Shapiro, 1998).

Further limitations regarding interviews arise when using technology (e.g., Skype, Zoom, Google Hangouts, iPhone FaceTime) to conduct the interviews, particularly regarding participant recruitment and study participant behaviors. Our pool of potential study participants may have narrowed as individuals outside of the Twin Cities metro area who were not adept at using this technology bypassed the interview opportunity. In addition, participants with little experience using the technology may have behaved differently during the interview than they would during an in-person session (Lichtman, 2014). Moreover, whether conducting in-person or virtual interviews, audio recording only captures verbal responses. Alternatively, video recording interview sessions would document body language of study participants, as well as that of both

researchers. Although a second researcher documented as many observed nonverbal responses as possible, this approach does not guarantee that we captured all significant nonverbal elements.

Sampling Procedures and Data Sources

Given the phenomenological inquiry of this research project, it was crucial that we sampled people who actually experienced the phenomenon of SDN (Creswell, 2007). We initiated a multifaceted strategy of purposive sampling to obtain 13 study participants who were at least 18 years of age, self-identified as currently using SDN in their daily lives for at least 90 days and could participate in an in-person or online interview in English. Daily practice encompassed ongoing awareness of thoughts and actions, focused attention on redirecting thoughts and actions, and consistent efforts to change thoughts and actions. We excluded individuals not currently residing in the United States. We follow discussion of purposive sampling with an overview of our study participant recruitment strategy.

Purposive sampling. Purposive sampling is a process in which researchers target participants based on a common characteristic or trait tied to the research questions or problem (Higginbottom, 2004; Creswell, 2014; Butler-Kisber, 2018), with the goal of selecting "information-rich cases whose study will illuminate the questions under study" (Patton, 2002, p. 46). Because we sought to document the lived experiences of participants who use SDN rather than to produce a statistically valid sample of the entire population, we believe purposive sampling allowed us to target a population best suited to answer the research question at hand.

While we believe this approach provided the best opportunity to collect relevant data to answer our research question, we also acknowledge its limitations. Seeking to identify themes about the lived experiences and their related meanings among research participants, we structured our sampling procedures and identified our data sources accordingly. However, we

fully recognize that a limitation of purposive sampling is that it does not allow for generalization among a broader population (Creswell, 2014; Higginbottom, 2004). Furthermore, sampling bias from each approach may occur as the researchers ultimately decide whom to approach to participate in the study.

   Recruitment strategy. As indicated in Appendix A, our recruitment strategy first consisted of contacting six experts in the field of SDN, including several noted researchers and authors, to request their assistance with participant recruitment. In our initial outreach, we asked each expert if they were willing to help us recruit study participants by providing our recruitment flyer (see Appendix B) to respective clients for their consideration, emailing possible participants and asking them to forward it to anyone who might be interested, and/or passing our request on to other professionals who might also be able to help with recruitment. Five agreed to support our recruitment efforts by posting our recruitment flyer on their website, sharing information during conference calls, and emailing to their client list. Working with experts provided assurance that our study sample was knowledgeable and engaged in the use of SDN. We supplemented these recruitment efforts by targeting two SDN-practicing Facebook groups—Neural Retraining Friends and Faster EFT—via scripted recruitment messaging (see Appendix A). We subsequently received over 100 responses to our recruitment efforts from prospective study participants. Ultimately, several individuals self-selected out of the study, several more failed to meet our interview criteria (e.g., residing in the United States), and many others responded after we arrived at the number of interviews we deemed necessary for our study.

      Upon receipt of an inquiry to participate in our study, we emailed all interested individuals a consent form (see Appendix C), as well as indicated our availability via email or telephone to answer any questions regarding the consent form. Upon email confirmation of an

individual's desire to participate in the study, we confirmed whether the individual was

interested in participating in an in-person or virtual interview. If conducting an interview in

person, we emailed the study participant directions to the interview venue. If conducting an

interview virtually, we confirmed the study participant's preferred technology (i.e., Skype,

Zoom, Google Hangouts, or iPhone FaceTime). In each case, we confirmed with the study

participant a convenient time and day for the interview.

Instrumentation

In this section, we detail our instrumentation. We first provide an overview of our

interview guide. We then discuss researchers as instruments within the interview process. We

finish by highlighting our use of field notes as an additional measurement tool.

   Interview guide. We developed an interview guide (see Appendix D) to translate our

research question into a series of exploratory questions we asked study participants in an easily

understandable manner (Brinkmann, 2013). As a tool for systematic organization, an interview

guide ensures that researchers apply procedural standardization from one interview to the next,

account for all information gathered throughout the interviews (Creswell, 2014, p.194), and

satisfactorily cover all targeted areas and themes of interest (Brinkmann, 2013). Finally, the

guide translates key areas of inquiry into "questions that can be posed to interviewees in a

language that makes sense to them" (Brinkmann, 2013, p. 59). We employed several resources to

guide the drafting of our interview guide, including a review of academic literature, referencing

qualitative interviewing books, research professor feedback, and research team collaboration

guided by our research question and interview method.

We piloted our interview guide with two people, including the demographic and

interview questions. A pilot is a "specific pre-testing of research instruments, including

questionnaires or interview schedules" (van Teijlingen & Hundley, 2002, p. 33). Both an in-person and virtual pilot to evaluate the interview guide and questions helped ensure that our participants could understand our questions and that our interview questions would optimally answer our research question (Creswell, 2014). It also helped identify unanticipated problems related to the interview process, confirmed the verbiage and order of questions, and gave interviewing researchers an opportunity to practice and enhance their interviewing skills prior to conducting interviews in the actual study (van Teijlingen & Hundley, 2001). Based on the results of the pilot, we inserted into the pre-interview checklist a grounding exercise to immediately precede the interviewee welcome, condensed the overall pre-interview process, reformatted the sequencing of the request for an interviewee pseudonym and demographic questions, and incorporated more clear direction regarding the start of audio recording.

Our interview guide provided step-by-step directions for our entire interview process, including researcher pre-interview actions, during-interview actions, and post-interview actions. In addition to the inclusion of demographic and interview questions, the guide offered a field notes overview, psychological services information, a note-taking framework, and pre- and post-interview protocol checklists. In addition, we designed and integrated demographic questions to obtain information specific to the type(s) of SDN used, extent and frequency of use, and what is/was addressed using SDN.

During-interview protocol encompassed introductory scripting for the actual interview, the interview questions, and field notes documentation. With respect to conducting the actual interview, the guide included six semi-structured, open-ended questions intended to frame the interview and allow for follow-up questions (i.e., to provide more detail or elaborate on responses). The questions asked included: *Tell us a bit about yourself and what led you to self-*

directed neuroplasticity? Please describe how you use self-directed neuroplasticity. How would you describe your experience or experiences with self-directed neuroplasticity? What changes, if any, have occurred in your life since you began using self-directed neuroplasticity? What meaning do these changes hold for you? Is there anything else related to your lived experience of self-directed neuroplasticity that you'd like to share? Upon completion of an interview, post-interview protocol first provided the interviewing researcher guidance for initiating a scripted debriefing with the interviewee. During the debriefing, the protocol directed interviewers to ask interviewees if there was any additional information they would like to add or ask about. The protocol prompted the interviewing researcher to highlight the key points from the interview and to be open to feedback, as well as conduct a final "consent" check-in. In addition, post-interview protocol cued the interviewing researcher to ask how the interviewee was feeling, highlight the availability of psychological resources, and provide (via email, if a virtual interview) a *Psychological Resources* handout (see Appendix E). Furthermore, the protocol outlined next steps—including transcription timeline, review, and feedback/confirmation expectations—prior to prompting the interviewer to ask the interviewee if there were any additional questions and to close via a gratitude statement shared with the interviewee. Finally, the post-interview protocol directed the researchers to complete a 15-minute reflection of the interview.

To enhance validity of our data collection process and enhance the accuracy of each interviewee's account (Creswell, 2009), we incorporated several grounding and reflexivity steps into the interview guide. During the pre-interview phase, we included a brief reflection and "letting go" regarding our respective lenses, followed by a three-minute meditation/grounding exercise. Additionally, post-interview protocol stipulated a 15-minute time allocation for reflection, as well as documentation of that reflection within the field notes for each interview.

The opportunity for sustained, deep reflection may improve the acuity of the research and contribute to more profound and multifaceted analysis and results (Tufford & Newman, 2010). To establish truth-value, or credibility, we allotted substantial time within our interview protocol, both during the interview and subsequent follow up, for engaging with study participants to discover relevant perspectives and potential themes and meaning.

There are several limitations related to the interview guide for this research project. First, responses to semi-structured questions required careful, time-consuming analysis and discernment so we did not interject our own biases and beliefs during interpretation. Although facilitating simple and prompt responses, the demographic questions were quite abbreviated with respect to the type, volume, and degree of information they procured. In addition, the interview guide's semi-structured-question format created extensive interview transcription time due to the length of exchange incurred between the interviewer and interviewee. That said, we made several rounds of edits to the interview guide—based on professor feedback, the results of our two pilot tests, and additional research team collaboration—to fine tune the questions, introductory scripting, and interview process action steps.

Researchers as instruments. As researchers conducting the interviews and analyzing data for this study, we were instruments for qualitative data collection, retrieval, analysis, and reporting (Lichtman, 2014) through the examination of documents, interviewing participants, and/or observing behavior and analyzing data (Creswell, 2014). Serving as the instrument across all phases of a qualitative research project (Starks & Trinidad, 2007), we facilitated receptive, conversational interviews, using our skills to nurture a natural emergence of meaningful information (Patton, 2002). With respect to our own potential biases, it also was essential that we

recognized how our relationship as a researcher with the interviewee would affect the data (Lichtman, 2014).

Our critical and constructivist paradigms, the interweaving of our interview guide with each researcher as an instrument, and our professional and personal backgrounds each shaped our strengths as researcher instruments for this research project. Through our collective careers as a registered nurse, flight attendant, marketing professional, and health coaches, we generally interact and build rapport with ease. We believe this skill assisted us in generating trust and comfort among study participants. Moreover, previous training and experience in conducting semi-structured, open-ended interviewing anchored in disciplined inquiry, as well as our naturally inquisitive and engaged-listener natures, facilitated effective and consistent navigation through the interview process while promoting deeper, more meaningful collection of data. As researchers, we immersed ourselves in learning qualitative and phenomenological research design, as well as the interview method—devoting significant time to reading, meetings, discussions, and classroom instruction. In addition, our collective immersion in the study of SDN via both the academic literature and popular press and our ongoing personal experiences with its application enhanced our ability as instruments to successfully extrapolate the breadth and depth of lived experiences shared, as well as effectively analyze, interpret, and report them. Our individual commitment to practicing SDN strengthened our credibility both with our participants and as researchers (Creswell, 2009). Each researcher applied foundational SDN principles outlined in our study (i.e., awareness of thoughts and actions, focused attention on redirecting thoughts and actions, and consistent efforts to change thoughts and actions) to our respective lives to better understand the potential significance of the phenomena around lived experience.

Finally, each researcher individually spent significant time practicing the consent process, scripted sections of the interview, interview action steps, and the use of probing questions.

We acknowledge each interviewing researcher has her/his own unique personality and interview style that others cannot replicate. In addition, each researcher's biases, prejudices, or knowledge of the subject may influence the interpretation of interviewee responses (Creswell, 2014). However, as an instrument for data collection, we have control over the interview process through bracketing (Patton, 2002)—a technique used by phenomenological researchers to first identify and then set aside perspectives on a research topic (Lichtman, 2014), responsive interviewing, and reflexivity to obtain authentic information from interviewees (Patton, 2002). Throughout the research project, we frequently and collectively discussed and reflected on our individual experiences, notions, and potential biases regarding SDN. Just prior to each interview (including between back-to-back interviews on the same day), we conducted a reflection and grounding exercise, whereby we first reflected on and then let go of any assumptions, experiences, learnings, or other influences that potentially could introduce bias into the interview process. We immediately followed by setting an intention of openness to exploration and discovery for the greatest research good and concluded with a three-minute meditative breathing exercise. Our awareness of bracketing further strengthened research rigor by mitigating the potentially unfavorable effects of unacknowledged preconceptions related to the research (Tufford & Newman, 2010). Furthermore, our awareness of individual researcher backgrounds and biases helped facilitate research validity and reliability through mindfulness around reflexivity (Creswell, 2014). In addition, memorizing and becoming comfortable, as well as fluent, with the interview guide helped each interviewer relax and focus on his/her body language and maintain a "connection" with the interviewee.

We further initiated efforts to mitigate potential bias arising from our individual lenses, including piloting and then refining our interview guide and questions based on feedback from individuals using self-directed neuroplasticity. We also sought the review and subsequent approval of transcripts by each study participant to enhance data accuracy and support the synthesis of data for analysis. Despite these efforts, we recognize that the research remains largely grounded in constructs arising from our own experiences.

   Field notes. Our third instrument, field notes, complements the verbal interview exchange between the researcher and study participant. Brief, handwritten notes transcribed during the interview, field notes allow for documentation of body language, as well as other nonverbal communication. Taken throughout each interview, we used field notes to clarify information, as well as capture nonverbal content (Merriam, 2009). Having an organized, standardized guide to document field notes supported greater observational consistency among the three researchers conducting the interviews. Both our field notes criteria and documentation form were provided in the interview guide (see Appendix D).

   Field notes may distract from the interview process and thus be a limitation to obtaining additional data. Although field notes contribute meaning and deeper content, they do not capture all of the nuances of the interview (Patton, 2002). In addition, observations of nonverbal communication can be subjective. As a result, experiences and interpretations may have differed among the three researchers in the research project. Even with the standardized field note criteria adhered to for each interview, the breadth and depth of field notes observed and documented were subject to the variability of each researcher. Finally, having an additional researcher in the session taking field notes may have been uncomfortable for some participants. To mitigate this

risk, both researchers participating in an interview attempted to build rapport with each interviewee by introducing themselves prior the interview and answering questions together.

Data Collection Procedures

Due to the wide geographical spread of our participants, we conducted 11 of the 13 interviews via virtual technology. Six of those participants preferred Zoom while the remainder preferred Skype. Two participants lived locally and agreed to face-to-face interviews held in a private study room at the St. Catherine University library. The length of the recorded interviews ranged from 44 minutes to 79 minutes.

Researchers arrived at the interview site at least 30 minutes prior to the interview to allow for set up and to address any unanticipated technical complications. During this time, we reviewed the interview guide and tested the recording devices to ensure they were functioning properly. In addition, we participated in a reflection and grounding activity to support our bracketing process. This activity included a brief self-reflection focused on recognizing and then letting go of any potential influences, setting an interview intention of openness to exploration and discovery, and then engaging in a "clearing" three-minute breathing space meditation.

Interviews conducted via video technology required additional preparation time to ensure internet connectivity, as well as functionality of the video technology platform and audio-recording devices. Each researcher downloaded the necessary software to complete video interviews prior to arriving at the interview site. All researchers brought a recording device and laptop with a camera and microphone as backup in the event of technological difficulties.

To more fully capture the essence of our participants' experiences, we used two researchers for every interview. Once the study participant arrived at the interview site or joined the video call, the lead interviewing researcher welcomed the participant, introduced the

researchers, and conveyed the purpose of the study. We reviewed the consent form and obtained

verbal consent from all participants. We then discussed the availability of our *Psychological*

Services handout and reconfirmed the use of audio-recording devices upon starting the interview.

We also reiterated the participant's right to discontinue the interview and audio recording at any

time.

Per our interview guide, we obtained a pseudonym for the interviewee before turning on

the recording devices. The lead interviewer then asked four demographic questions followed by

six semi-structured, open-ended interview questions. Following the interview guide, the second

researcher documented nonverbal observations in the field notes form in addition to supporting

the lead interviewer, if needed, with probing questions. We captured interview dialogue by the

audio-recording devices while the researcher taking field notes described the date, time, location,

and nonverbal content of the interview—e.g., body language, facial expressions, and

characteristics of speech such as volume, tone, rate, and cadence. Upon completion of the

interview questions, we asked each interviewee if they had any questions or additional

information to add. We solicited a final verbal consent and then turned off the recording devices.

Immediately following the interview, both researchers engaged in a 15-minute tranquil period to

record any thoughts, observations, and reflections on the interview process.

Within one week of the interview and upon completion of both researchers' review of the

audio-recording and transcript, we emailed the transcript to the interviewee for review. In

addition to providing the transcript, the email requested that the interviewee review the transcript

in its entirety and, via email, confirm its accuracy, or specify any areas requiring additional

clarification. Finally, the email reiterated that an e-gift card would be sent upon completion of

this review-and-confirmation step as a "thank you" for participating in the study. Four

participants required a follow-up "reminder" email to complete the transcript review. Seven

participants suggested we make minor, non-substantive edits to their transcripts. Another two

participants further clarified concepts they discussed during the interview, while also providing

considerable additional information. After receiving email confirmation of transcript accuracy

from an interviewee, we acknowledged via email our receipt of the confirmation and provided

the "thank you" e-gift card.

Data Analysis Procedures

We used thematic analysis that included concept mapping and block-and-file methods to

analyze the interview data. Thematic analysis is a process used to analyze large sets of data in

order to establish themes or commonalities (Nowell, Norris, White, & Moules, 2017). Themes

represent patterns across data sets and are essential to describing a phenomenon related to a

particular research question (Daly, Kellehear, & Gliksman, 1997). Because thematic analysis

offers both the flexibility and freedom to tailor an approach for the data within a

phenomenological research context, it best met the needs of our project. By using an inductive,

or bottom up, approach, we actively engaged with our data to drive theme generation. Through

this process, we were better able to uncover any meanings lying within the identification of

central themes (Grbich, 2007) that our study participants made of their lived experiences using

SDN.

When using thematic analysis, concept mapping, a block-and file-approach, or a

combination of the two, can facilitate data management (Grbich, 2007). Concept mapping breaks

responses down into simple words or phrases placed under emerging themes (Grbich, 2007).

With the block-and-file approach, researchers identify passages from the data by either

highlighting or underlining relevant statements. They then transfer them in their entirety to a

table organized by emerging themes. Using a combination of the two thematic systems enables researchers to conceptualize the final product (Grbich, 2007). This combined approach was most appropriate for our research project. The concept-mapping approach provided us a simpler, visual representation of emerging themes (Grbich, 2007). Alternatively, the block-and-file approach of thematic analysis allowed us to organize passages into various themes while maintaining the context from which the participants offered the information.

We initiated our data analysis with the lead interviewing researcher reviewing the transcript within two days of completing each interview. The researcher listened to the audio recording of the interview and, with the assistance of Trint transcribing software, completed transcription of the interview. To promote data accuracy, we forwarded the audio and transcript to the non-interview-participating member of the research team for additional review. In the spirit of reliability and validity, the transcripts were reviewed a total of three times: twice by two separate researchers, and once by the interviewee to confirm for accuracy.

Once researchers and participants verified all transcripts for accuracy, we individually reviewed every interview transcript twice, from beginning to end, to identify any significant passages related to our research question, assigning corresponding codes (i.e., prescribing meaning to each passage) and writing any additional relevant notes in the margins. Our team then met for eight days over a three-week period to collectively review and analyze the data. Again, using a beginning-to-end transcript-review approach, we collaboratively compared and contrasted each transcript and associated initial coding, including potentially overlapping codes, to arrive at more formalized, collective codes for the data.

Following collective coding, we initiated preliminary theme generation. To represent initial themes in a more concise and visual way, we started with concept mapping. To strengthen

the reliability and validity of our analysis, we first individually undertook a horizontal, question-by-question review of our collective codes for each interview across interviewees. We conducted this review in two passes, with the first review completed in one direction with respect to the order of interviewees and the second pass completed in the reverse direction. During this process, we proactively visualized connections/relationships in and among codes, validating linkage to our research question. We then collaboratively discussed and narrowed relationships of codes to generate preliminary themes. We also assigned a specific color to each participant's codes in order to determine each study participant's association with emerging preliminary themes, as well as the depth/weighting of each participant's codes among those preliminary themes. Following concept mapping, we initiated the block-and-file approach by assigning preliminary-themed column headings generated from the aggregation of concept-mapping codes. Cutting and pasting related data from the transcripts beneath the column headings, we supplemented relevant codes with the full context of the data associated with those codes. After completing the preliminary block-and-file table, we read all passages under every column and began to generate final themes and subthemes. For additional context, we collectively reviewed the field notes recorded for each interview, as well as the reflections the researchers documented immediately following each interview. As part of our collective reflexivity, we also carefully examined any "outliers" within the context of our themes. To check against potential assumptions and bias, we determined if the outliers were truly anomalies, or instead, part of a greater theme or subtheme that we could use to create a richer, deeper, and more complex analysis of the data. Finally, once we established the final themes, we wrote a detailed description of each, using quotes from participants' responses to provide additional validating context to our description.

Rigorous thematic analysis can yield findings that are both trustworthy and insightful (Nowell et al., 2017). Furthermore, thematic analysis does not require the technical knowledge and procedures of other forms of qualitative data analysis, making it accessible and fairly user-friendly, especially to those without much research experience (Braun & Clarke, 2006; King, 2004). Because it requires researchers to apply a well-thought-out strategy for working with data, thereby facilitating creation of a report that is both clear and structured, thematic analysis also can be effective when highlighting critical components associated with larger data sets (King, 2004).

Although the flexibility of thematic analysis may lead to a data analysis procedure that aligns with the purpose of the study while generating trustworthy and insightful findings, we understand that thematic analysis has limitations. For example, this approach may lead to inconsistency of coding and analysis of data if researchers do not follow the same procedure throughout the data analysis process (Nowell et al., 2017). Moreover, the block-and-file approach to organizing data can become overwhelming with too much information, while concept maps can oversimplify the results and remove context (Grbich, 2007). To balance these potential weaknesses, we leveraged a strategy of incorporating both processes into our data analysis. However, while using both block-and-file and concept mapping can mitigate risk associated with each approach, their combined use was extremely time-consuming.

Design Rigor

To demonstrate trustworthiness in our research, we addressed the critical concepts of reliability and validity in our process. When discussing reliability and validity, Brink (1993) states, "meticulous attention to these two aspects can make the difference between good research and poor research" (p.35). To assure greater reliability and validity, we maintained a high level

of communication throughout the design, data collection, and analysis phases of our project. We also documented each process associated with our research project along with any modifications made throughout the study. We specify the various steps we implemented to complete the study earlier in our Method chapter, as well as the actions we undertook to reduce our influence on either the research project or our study participants. During overall design content development, we consistently reviewed each other's writing, shared recommendations, and collaboratively edited all sections. Furthermore, through our faculty advisor and in-class research peer reviewers, we sought varying perspectives beyond our own. In addition, we actively sought out and engaged contrarian information (e.g., existing research literature, anomalies revealed during data analysis) in order to challenge themes (Creswell, 2014).

Through reflexivity, we made a consistent effort to critically reflect on all stages of the project. This effort included meditating, surfacing any issues during our research meetings, and journaling. Josselson (2013) notes, "The reflexive attitude becomes one of noticing what you *are* doing in the interaction, rather than trying to maintain the illusion that you are doing nothing at all" (p. 27). Before every interview, we initiated a brief meditation session. We further incorporated meditation at the start of each data analysis session. As a research team, we proactively and regularly coordinated dynamic discussion and analysis of unforeseen challenges. We captured all emerging decisions in a log for reference and further discussion, if applicable. From there, we collectively worked to find prompt, responsive solutions (Creswell, 2009). We also implemented a journaling process at the onset of our first pilot interview to promote more robust data analysis. Through this process, each researcher individually documented details, decisions, concerns, challenges, reflections, or anything else considered significant throughout the course of data collection. Our field notes' criteria, format, and documentation process

remained the same throughout data collection. This approach supports an additional layer of reliability and validity to our research (Creswell, 2009). Additionally, we recognize our personal, professional, and theoretical assumptions or biases in the Lenses chapter of this thesis. In response to these assumptions and potential biases, we remained cognizant of reflexive bracketing throughout all phases of our research project.

Protection of Human Subjects

Beyond any consideration regarding our research objectives, we first treated our participants with respect, sensitivity, tact, and integrity (Josselson, 2013). When operating within the critical and constructivist paradigms, one deems ethics to be nearly or completely intrinsic. Furthermore, researchers demonstrate ethical constructs by a desire to alleviate both misapprehensions and ignorance, as well as to fully account for values and historical perspective throughout the process of inquiry (Guba & Lincoln, 1994). Therefore, inquiring researchers typically hold a revelatory rather than deceptive moral leaning. The rigor associated with fully informed consent exemplifies this leaning (Guba & Lincoln, 1994). While such considerations do not prevent unethical behavior, they do offer process-related obstacles to it (Guba & Lincoln, 1994).

Each of us completed the Collaborative Institutional Training Initiative (CITI) to help us better understand research ethics. Because our research utilized human subjects, we considered any risks to participants including consent, confidentiality, protection of privacy, and possible emotional distress.

Consent. We obtained consent from participants both verbally and in writing prior to the interview, again verbally at the *end* of the interview, and finally when we sent a copy of the transcript to each participant to review. We believe taking extra measures to further confirm consent, including asking participants at the end of the interview if they still wished to give

consent, provided additional assurance of our responsibility to ethical duty (Josselson, 2013).

Confidentiality. Confidentiality pertains to a situation in which a researcher knows the identity of a study participant yet strives to prevent others from discovering that identity (The Evergreen State College, 2018). Given we conducted qualitative inquiry in which we used individual quotes, it was especially pertinent that we considered how we would protect the confidentiality of our study participants (Brinkmann, 2013). We also recognized that because we were conducting face-to-face interviews, complete anonymity was impossible. Moreover, we agree with Smith (1992) that ethical interviewing must begin with the interviewing researcher. Therefore, we each recognized our respective responsibility to both offer assurances of confidentiality and make every effort to ensure that the principle of confidentiality was upheld (Streubert & Carpenter, 1999). For example, we used data in an unidentifiable way within our study by soliciting pseudonyms from each study participant prior to the start of an interview. No study participant's name was used in audio recordings, transcripts, field note documentation, or subsequent analysis and reporting. To further protect confidentiality, we did not capture study participant gender or location information.

We also took the following steps to address the issue of confidentiality: created a separate project email address, secured the storage of data, initiated de-identification of individual participant information, and ensured destruction of identifiable individual data. Upon completion of each interview, the interviewing researcher collected hard copies of reflective notes, along with the demographic information and field notes from the interview, and stored them in a transportable, locked file cabinet. Because not all researchers were present at every interview, each researcher had their own locked cabinet to store this documentation. If needed, we

transported hard copies of data by hand in the locked file cabinet for collective review and collaborative discussion. Following an interview, the interviewing researcher downloaded the audio file of the recorded interview, creating an electronic file. We then secured any electronic data, including audio files, in password-protected documents and uploaded them to our password-protected university Google drives. We stored all identifiable information, electronic or hardcopy, separate from de-identified data (i.e., demographic information, transcripts, and project results). Throughout the entire project, only the three research team members and our advisor had access to the data. We will destroy all identifiable documents by July 31, 2019 and keep all de-identified data indefinitely.

Protection of privacy. A second ethical consideration entails the protection of study participant privacy. All research participants hold a realistic belief that their privacy will be protected (Lichtman, 2014). Therefore, we did not reveal, in either writing or verbal communications, any identifying data regarding study participants. Following multiple collaborative reviews and discussions among the research team, and feedback from our research professor, we piloted and then refined our demographic questionnaire to eliminate any questions such as gender, age, and location that might create an unnecessary breach of privacy while providing little or no research value.

Risk of emotional distress. Because we employed an interview method to understand the lived experience of individuals using SDN, our final area of ethical consideration involves the risk of some corresponding emotional distress. For example, as people talk about their personal experiences, emotions may evolve and emerge. These emotions may encompass a variety of feelings from joy to stress. We addressed this risk within the informed consent form (e.g., stating that participation in our study may involve or bring out increased stress or personal feelings).

Participants in our study or researchers could stop the interview process at any time and without penalty. Because study participants may be vulnerable during the interview process, each researcher remained sensitive to any exploitation of participant vulnerability. Finally, we provided each study participant a *Psychological Resources* handout (see Appendix E) upon completion of the interview. This handout outlined a number of free and sliding-fee-scale local and national services in the event that a study participant experienced psychological distress after leaving the interview. No participant informed us of emotional distress either during or after the interview.

Design-Specific Limitations

Every research project has design strengths, as well as limitations. In this section, we note the specific limitations associated with the design of our study.

Because SDN is an emerging area of study, we discovered a scarcity of academic research prior to designing our study. While we comprised a set of foundational concepts pertaining to SDN following a review of the academic literature that extended into the popular press, the lack of available literature limited our ability to design and develop a study that benefited from previous research findings. For example, considerable variability exists regarding a specific definition of self-directed neuroplasticity. This lack of definitional clarity influenced every aspect of our design, from the most fundamental development of interview questions to data collection, analysis, and interpretation.

Our learning curve as researchers also presents a limitation. We were quickly learning the concepts of research design while simultaneously developing a study specific to our research project. Throughout the design process, we often did not know what we did not know—whether it be addressing specific design requirements related to sampling procedures, instrumentation,

data collection, or data analysis. We continued to refine our research design based on additional faculty instruction and self-initiated learning throughout the design process. Yet, we acknowledge, as novice researchers, that potential shortcomings in terms of knowledge and experience may have negatively affected our research design.

Time constraints imposed an additional limitation for our research project. For example, in conducting the study within an academic setting, we had just over two months to complete both data collection and data analysis. Utilizing SDN experts and Facebook groups to support our purposive sampling approach also required time-intensive coordination, research team discussion, communication, and documentation within an already abbreviated research window. As a result, these and other time constraints challenged our ability to more thoroughly design, implement, and interpret our research project.

Results

"Any man could, if he were so inclined, be the sculptor of his own brain"
(Ramón y Cajal, 1897, p. xv).

The purpose of this chapter is to describe the results of our study, which asks: *What is the lived experience of individuals practicing self-directed neuroplasticity?* First, we provide a description of the participants and relevant background information. Next, we present observational data. Then, we offer descriptive context of our participants' self-directed neuroplasticity (SDN) practices. Finally, using supportive quotes, we share the four major themes that we identified in the data: *Seeking*, *Growth in Relationships*, *Empowerment*, and *Transformation*.

Description of the Participants

We interviewed 13 English-speaking adult participants who reside in the United States. The average length of time participants reported using (SDN) was just over six years; the shortest span of practice was nine months while the longest was sixteen years. Within their long-term practices, two participants reported heavier, more intense usage in the five and twenty-one months preceding the study, respectively. We chose not to collect other demographic data such as gender, age, and location because we felt the research value was minimal, and we wanted to protect the privacy and confidentiality of our participants.

Study participants reported using various SDN modalities that fall within our definition of SDN, which includes any practice that incorporates ongoing awareness of thoughts and actions, focused attention on redirecting thoughts and actions, and a consistent effort to change thoughts and actions. Table 1 outlines the various modalities participants use.

Table 1: SDN Modalities Used by Study Participants		
Modality	Description Access	Number of Participants
Neurosculpting®	https://neurosculptinginstitute.com/what-is-neurosculpting/	4
Positive Neuroplasticity Training (PNT)	https://www.rickhanson.net/get-started/	4
Emotional Freedom Technique (EFT)	https://www.emofree.com/eft-tutorial/eft-tapping-tutorial.html	3
Dynamic Neural Retraining System™ (DNRS)	https://retrainingthebrain.com/	3
FasterEFT/Eutaptics®	https://fastereft.com/	2
Gupta Program Brain Retraining™	https://www.guptaprogram.com/the-program/	1

Participants also reported using an array of SDN components, such as awareness of thoughts, attention to thoughts, focus on reframing and directing thoughts, bringing in the whole brain, focus on switching attention, mindfulness, setting intention, catching the good, and visualization. Finally, many participants described mixing modalities to customize their SDN practice.

In terms of frequency, each participant reported using SDN differently. Some have a dedicated daily practice encompassing nearly two hours per day while others use SDN on an as-needed basis. Most participants, however, reported using SDN every day, several times throughout the day.

Study participants used SDN to address a variety of physical, emotional/behavioral, and relational concerns. Table 2 details the specific reasons participants reported for using SDN.

Table 2: Study Participants' Reasons for Using SDN		
PHYSICAL HEALTH	**EMOTIONAL & BEHAVIORAL**	**RELATIONAL**
Brain Fog	Anger	Isolation
Chronic Fatigue Syndrome	Anxiety	Loneliness
Chronic Inflammatory Response Syndrome	Daily Stressors	Parenting
	Dealing with Change	Relationships (General)
Chronic Pain	Depression	
Ehlers-Danlos Syndrome	Feelings of Inadequacy	
Electromagnetic Field Sensitivities	Food Issues	
Lymphedema	Goal Achievement	
Mast Cell Activation Syndrome	Grief	
Multiple Chemical Sensitivities	Guilt	
Postural Orthostatic Tachycardia Syndrome	Limiting Beliefs	
	Negative Thoughts	
Significant Injuries	Overwhelming Feelings	
	Panic Attacks	
	Physical, Emotional, & Sexual Abuse	
	Post-traumatic Stress Disorder	
	Range of Psychiatric Disorders	
	Smoking Cessation	
	Trauma	

Observational Data

Here, we include observational data relevant to our results. All participants conveyed an openness and enthusiasm for the opportunity to participate in the interviews and share their experiences with SDN. In addition, participants consistently expressed excitement about the research project itself before, during, and after the interviews. Finally, many participants inquired as to when the project would be completed and accessible for review.

We observed a range of emotions from a number of study participants while they shared their stories. Participants often expressed these emotions when discussing progress within their SDN practices, which typically were characterized by chuckling, giggling, or laughter. Two participants also choked up while discussing SDN within the context of relationships among

family and friends. A range of facial expressions, hand gestures, and body language, as well as

shifting voice tone and volume, further illustrated various emotions. For example, several

participants consistently leaned in and spoke with greater intensity when emphasizing a

particularly poignant aspect of their experience.

Descriptive Context of Practices

The purpose of this section is to offer additional description and context regarding

participants' SDN practices. We first highlight the multiple facets our participants shared about

the processes associated with their practices. Next, we address the challenges associated with

SDN practice. Then, we explore the importance of support and guidance during practice. We

follow with a review of participants' appreciation for the neuroscience behind their SDN

practices. Finally, we discuss the significance of sharing SDN with others.

   Multifaceted process. All participants described experiencing a multifaceted process when

practicing SDN. For example, many reported a more intense and rigorous practice when first

starting. For some, this was due to a strong desire to promptly alleviate health struggles. For

others, it was due to pressing relationship challenges or the desire for perfection in their practice.

Numerous participants noted that SDN became *easier with practice* and that commitment to

practice improved outcomes. One participant talked about consistency saying, *I stuck with it and

I got to the point where I didn't feel like I was on fire…* Another participant described the process

over time:

> *It got easier for me as I went. It felt very helpful and encouraging because you would*
>
> *start to see, start to see changes, start to see evidence of healing and changes. So, then it*
>
> *becomes very motivating and exciting*.

Several participants initially implemented SDN for *crisis management* but eventually

transitioned to using it more proactively throughout the day. Others described using SDN more

frequently during difficult times. Still others explained how they adapted their practices by

combining a variety of programs or techniques to meet their specific needs. As their SDN

practices progressed, at least five participants described experiencing a ripple effect. This effect

ranged from realizing unintended, secondary benefits of practice to the application of SDN

beyond any initial intention. Five participants discussed the importance of self-care, with

lifestyle factors such as proper sleep, nutrition, and exercise recognized as enhancing SDN. One

participant summed it up as a *cascade of effects that just goes on, and then they just kind of start*

to work in a circle with each other for proper brain function. Within the multi-faceted SDN

process, participants also reported experiencing a number of challenges.

   Challenges. All participants acknowledged challenges associated with SDN. Some discussed

an *internal struggle* with maintaining a consistent practice, whether due to *boredom* or *difficulty*

of practice. Another expressed a struggle with *letting go of old belief patterns*, and yet another

reflected on how *old thinking creeps in* even when practicing regularly. One participant

explained how an awareness of SDN creates an obligation to live proactively:

> *Once you are aware that you can do this, then you're almost obligated to, you know...*
>
> *Because if you have negative thoughts and know that you can do something about it, then*
>
> *you can't just sit lazily accepting the negative thoughts. So, it's like it almost creates*
>
> *more work in some ways.*

In addition, four participants specifically reflected on *kickbacks*, or rebounding symptoms, after

seeing initial benefits. Several discussed *resistance* in the brain by *going too hard, too fast*,

resulting in the temporary yet significant and frightening exacerbation of symptoms. A

participant described this scenario in the following way:

> *If I just kind of go hard from the beginning and just push myself, then it seems like my*
>
> *nervous system just freaks out, and the symptoms just get worse.*

Others communicated their experiences with short-term setbacks when first trying on their own

to address more significant challenges through SDN. Another participant indicated a tendency

early on to self-sabotage by *looking for all the ways it wasn't working*, without realizing it. To

address these challenges, many participants tapped into mentors or guides.

 Support from mentors or guides. More than half of the participants specifically reflected on

the value of a mentor or guide in their SDN practice. For some, it wasn't until they consulted

with a coach or expert who specialized in their particular SDN practice that they felt they

experienced the full benefits of SDN. For example, a participant shared an experience of upfront

skepticism and misconceptions about SDN, along with being overwhelmed at the prospect of

adjusting an entire way of thinking about life. *Coaching was a huge, huge part of self-directed*

neuroplasticity working to overcome limiting beliefs that prevented progress. Another participant

reflected on a conversation with their mentor during the early stages of using SDN:

> *For months, like three months, I couldn't even get through one…'So, I gotta' tell you, I*
>
> *think I've been doing this wrong'… And she was like, 'No, no… that's totally normal'…*
>
> *Here I thought I was messing it up, and really, I'm doing it.*

In addition to early practice, several other participants conveyed that this guidance and support

was particularly beneficial when attempting to *work on the big step* where there may be a

tendency to practice too aggressively. In addition to benefiting from mentorship, participants

consistently conveyed an appreciation for the neuroscience behind SDN.

Appreciation of neuroscience. Nearly all study participants indicated an appreciation for the foundational role of neuroscience behind their SDN practice, including *limbic system dysfunction*, the role of the *prefrontal cortex, whole-brain recruiting*, *negativity bias, stress response*, *maladaptive circuitry,* and *pruning of old neural pathways while building new pathways*. One participant enthusiastically provided perspective regarding the neuroscience behind SDN:

> *I geek out over this stuff. I think it's fascinating. When I learned that we have some control over how our brains function chemically and how it affects me psychologically… you know, get out of my way. I need to learn more...*

Another participant reported having *learned loads about the brain and how the brain works, and how the brain processes stress*. Still another participant expressed an emerging belief in the science behind SDN:

> *All of this is just neurons in your brain firing one way you've been taught, and… even though it doesn't feel like it, you just teach yourself the other way of thinking, and eventually you get those neurons firing enough… And you know, eventually… I guess, believing in the science of it.*

Some of the participants referenced how SDN drew their attention to the *subconscious reacting in the body* or how SDN provided *a new way to look at the subconscious... that there is no good or bad situation... just a bunch of data*. Several participants provided more in-depth perspective, including:

> *The subconscious work is happening.... even if I'm not consciously aware, so… That to me was the interesting part. But it can just… your brain does so much for you… when you don't even pay attention to it.*

Finally, an additional participant compared the brain's circuitry to a computer's *operating system* with *brains kind of creating new connections and trying to make sense of it*. Beyond the vast majority of participants embracing the neuroscience associated with SDN, many also proactively advocate for SDN.

Advocacy for SDN. Most of our participants expressed a desire to share the benefits of SDN in order to *help others* or to *pay it forward*. This advocacy for SDN transcended family to include acquaintances, wider audiences, and even strangers. With respect to family, one participant summarized the collective perspective regarding the importance of SDN advocacy:

> *But I feel like the benefit for it potentially even kind of becomes greater because it becomes a family process of plasticity. And that's also very empowering and exciting as well. Because not only that neuroplasticity is a component of who I am, but that's now kind of a family unit movement.*

Several participants specifically mentioned the importance of *passing down to the next generation* or *sharing with children* beneficial information about SDN by directly introducing various tools and/or modeling SDN-related behaviors. One participant mentioned *being over the moon... to be able to take these tools and pass them on* to their child. Another stressed that SDN should be *part of teaching* and *taught as classes in elementary and high school*, while adding *SDN* is *just stuff you should learn from your parents*.

Other participants communicated their desire to promote SDN among acquaintances simply as a way of *helping others help themselves*, and more expansively:

> *I love sharing it with other people… Because I've been there… Like, I know. This is the guy that also has gone through chronic pain and has a lot of it, and he's been battling it,*

and had the same, you know, no-hope diagnosis type of deal… And it's like, try this. You

know, I can't promise anything, but give it a whirl…

Still others want to provide broader-based advocacy for SDN across larger groups, as

reflected in the following statement by a participant:

But yeah, it's made me very passionate about wanting neuroplasticity and the benefits to

really become part of treating chronic illness.

In contrast, another participant shared a belief in advocating the benefits of applying SDN

in basic, one-one-one casual encounters, such as helping pull an extremely agitated individual

out of a ranting episode through the application of reframing and redirection. In addition to this

broader context of an SDN practice, we uncovered four themes.

Themes

In order to describe the lived experience of individuals practicing self-directed

neuroplasticity, we generated four themes from our inductive data analysis approach. The first

theme is *Seeking*, followed by *Empowerment*, *Growth in Relationships*, and finally,

Transformation. In this section we describe each theme in detail and provide supporting quotes.

Seeking. This theme explores how our participants ultimately turned to SDN for answers. All

study participants described reaching a point in their lives where they recognized their current

path was not working and consequently decided to challenge their personal status quo. The

impetus for seeking fell along a spectrum from general learning for personal and/or professional

development to desperation in the face of ineffective medical treatment for chronic illness. One

participant encapsulated the theme's proactive essence by stating:

You've got to do something, is kind of what I felt, like... I'm not going to live like this

anymore.

On one end of the spectrum, several participants described turning to SDN for personal and/or professional growth. One participant saw SDN as *an opportunity to improve* and another to become *a better person.* Another turned to SDN to increase overall enjoyment of life. Reflecting on a moment in life that triggered the quest for self-improvement, one participant said:

> *I just kind of had a wakeup call. Okay, that's not me, I don't want to be this way. I feel*
>
> *like I can do better. And at that time, I realized that I needed to work on myself.*

Another participant explained *it became kind of a personal quest and purpose of development in my life.*

With respect to professional relationships, a number of participants researched and incorporated SDN tools into their professional health practices with the hope of improving patient/client outcomes. One participant who owns a mental health clinic described *looking for other methods of helping my clients outside of the medication realm.* She further explained:

> *What I was finding is I had clients who were coming in who were… still struggling*
>
> *horribly, still asking for, um, increases in medications, and things just didn't seem to be*
>
> *clicking right in their minds...And so, as I... saw what it was doing in my own life and*
>
> *how it was changing my own thinking in that direction, I started to bring it in to my*
>
> *patients…*

Still another was seeking a way to help, as well as connect with people in a meaningful way professionally stating, *but I really want to get at the deeper stuff, at deeper stories.* For more than one participant, professional interest in SDN led to seeking and then initiating a personal practice.

On the opposite end of the spectrum, several participants turned to SDN as a last resort when allopathic treatments failed, or no other treatment options existed. Facing the ramifications of chronic stress arising from a traumatic family event, one participant reflected on the need for help:

> *My stress level kept going up higher and higher and higher and higher, and I started noticing chronic signs of that affecting my life... Like I didn't know what to do. I didn't know what to do when I woke up in the morning. It was so overwhelming... that's when I really dove more into this...*

Participants discussed starting the process of seeking answers through SDN for medical conditions, with one stating:

> *And so, I started doing some of my own research on the side of how you could, you know, tap into the power of this....*

Another participant articulated the beginning of the seeking journey:

> *I was on five meds a day and was to a point... doctors were telling me that I was just gonna be living like this for the rest of my life. Um...and that's when I started looking...*

Yet another participant recounted seeking alternatives to failed medical interventions:

> *So, it was kind of this realization that I needed to find a way to get better that did not involve ingesting anything. That it, it was just a matter of that... that's my only option, that or die...*

Three participants described the influential role their children played in their desire to seek a different path. They referenced wanting to be a good *role model* for their children. One participant stated:

> *Truly, honestly, there's nothing like children to... help. Well, for me, to help me be a*
>
> *better person. Honestly. And you can't give what you don't have.*

Regardless of the reason for turning to an SDN practice, all participants described a process of exploring a different, more self-empowered way to manage their current personal and/or professional life situation.

Empowerment. Every participant described becoming empowered through their SDN practice. Empowerment refers to the power of self-determination and control of life's circumstances. Participants described this as being in the *driver's seat* of life, having a *choice* and *control* over outcomes, *taking responsibility,* and *embracing one's own voice*. A quote from one participant captures the essence of empowerment:

> *But it's only when you're kind of in touch and intertwined with your emotional process,*
>
> *can you really just kind of take the driver's seat of your own development and your own*
>
> *brain's formation.*

Another participant reflected on *the power of how your thoughts actually control so much of your life*, while many discussed harnessing the power of thought to redirect to more desirable outcomes. For several, their SDN practice provided a sense of *hope*. One participant emphasized the tremendous potential resulting from the their SDN practice by saying, *I can be limitless with it.* Another described it as feeling *expansive and powerful* and that *so much more is available to me*. For yet another, it meant, *I don't have any restrictions in life anymore.* This sense of empowerment inspired one participant to declare, *I'm going to take my life back.* For an additional participant, empowerment is a core tenet of living:

> *I mean, if you ask me how I define living, it would be seeing experiences unfold and*
>
> *realizing that you have more control over those experiences than you know.*

Participants recognized the empowerment they felt to no longer repeat unhealthy or unhelpful patterns in their lives. One participant expressed, *it's empowering because we're not fixed. And we're not kind of... in a state that can't change.* Another participant reflected on the empowerment to not follow unhelpful patterns by saying:

*I know that I can work through that. It's just, it's just part of my neurology at the moment for whatever is going on, and I can work through that, and I can chang*e.

Additionally, a participant expressed empowerment in terms of the ability to override old patterns by recognizing old reactions and saying:

Oh, that's where I would've gone down. But I'm not going down that way anymore. Wow, this is really great!

When faced with chronic health concerns, another participant discussed the empowerment associated with choosing the path of health:

I have a choice to make whenever I have a negative thought or focusing on my symptoms or anything like that... I can either keep thinking that and go down the left path and remain ill and reinforce the pathways that are perpetuating my symptoms. Or, I can choose to go down the right-hand path… and interrupt the negative thoughts and embrace life and have health and happiness...

Among study participants, empowerment fueled greater self-confidence. One participant stated *whatever the world throws at me, I'm going to be able to get through it.* For another *it's just an increased degree of confidence... kind of an ownership of your own life.* Participants discussed setting and working towards goals with their SDN practice, with one describing it as *if I think it, I can reach it.* More than one participant attributed improved public speaking skills as a byproduct of their SDN practice.

Growth in relationships. Participants unanimously described varying degrees of evolution and growth in their relationships. Change did not happen in a vacuum; as the participants changed, so did their relationships. A participant reflected, *It was interesting to see how it affected everyone else around me.*

For some, the participants' own emotional growth was the catalyst for change in relationship dynamics. *When I, I know that when I change, that... the whole relationship will change.* A participant identified feeling more *trust* in others and the ability to *form deeper relationships and connections*, while another mentioned being more *present* for their loved ones. For an additional participant, relationship growth centered on a *greater connection* with their children; for yet another, it was a more general perspective that *relationships with people are so much better.* Tying into the increased confidence through empowerment to be more outgoing, another participant stated:

> *And I find that, I've met a whole lot more people than I thought I would. I've made several friendships that I didn't expect.*

An additional participant described how it *changes the energy... around you to other people.* One participant summarized this change in relationships as follows:

> *So, what I've learned is, I respond to other people differently. I treat other people differently. And in return they treat me differently as well.*

Several participants noticed an increase in *empathy* as a result of their SDN practices, leading one participant to reflect on difficult interactions with others:

> *I'm able to tap more into the empathy instead of having a stress reaction from it. So, you know problems with others, having relations with anyone on the planet, like that's, that's kind of like an umbrella change that's happened.*

For other participants, relationships expanded because they were no longer limited by physical symptoms. One participant explained that because their symptoms had dissipated, it now was possible to *get out again and be around people and do things.* Another participant described the meaningful impact on relationships:

> *It means I can travel and see family and see friends… I wasn't able to see them for*
>
> *several years.*

A change in health, actions, and/or beliefs affected the way others viewed several participants as well. One expressed concern over *ostracizing or being ostracized* by those in the chronic illness community as their health improved. Another participant described the process of training loved ones to think differently about their new, healthy life, stating, *so having to retrain their thoughts, as well as mine was a huge part of it.* Yet another described:

> *It's hard to change my old friends' opinions of me because they see, you know, they don't*
>
> *see all that. But like the new people I meet, I get much different interactions with them,*
>
> *and they're like, wow, you're such a positive person and you're always smiling to me…*
>
> *and, so yeah, with the new people I meet, they, they just have completely different results.*

No matter their reason for utilizing SDN, every participant reported growth among their relationships with others, as well as transformation.

Transformation. All participants reflected on the powerful transformative qualities of their SDN practice. Transformation describes the dramatic changes—mentally, emotionally, physically—that each participant reported. One participant described SDN as *giving me a new life*; another described transformation as *becoming who you are*. One simply stated *it means freedom*. More than one described it as *the difference between night and day.* One participant

reflected on the transformation experienced through their practice by saying, *it kind of gets to the core of who you are.* Another captured the essence of transformation in their life by stating:

> *Everything has changed, I guess you could say... I'm just like a 180-degree different person than I was before. In every way.*

Participants discussed transformation in all areas of their lives. One recounted the realization that *I'm not a broken person* and *it saved my life.* An additional participant stated, *my mind is changed. I have changed my mind. Life changing.* Another reported, *it really has given me a new way of looking at life in a situation. Giving me a new life.* For yet another participant, the SDN practice became part of their identity, stating:

> *I mean... the plasticity is just kind of an essence of who I am as well. Just kind of... life and unfolding, kind of unfolding who I'm becoming.*

For those who turned to SDN for health challenges, this transformation encompassed an obvious improvement in symptoms. When discussing the efficacy of their SDN practice, one participant stated:

> *And I would feel totally different by the end of it. Whereas if I might have started extremely fatigued, where it felt nearly impossible to even do a round of brain training, retraining... but by the end of it, I would have a ton of energy… and could go the rest of the day full of energy and complete work and social activities with no problem.*

Another described this health transformation as *a path towards getting completely well*, expanding on that by saying:

> *Yeah because previously, it was really just a continuous... vortex of getting worse and worse and worse... and then starting the retraining, it's really been… other than that one dip, it's been just improvement. And… that is, that's totally different.*

Additional transformation occurred on a spiritual level. Several participants shared how spirituality played a role both in their practice and in their life. One explained it as, *it's kind of like being held by the universe, or being held by God.* Another reflected that SDN helps with *tapping into a more spiritual side*, expanding on that by saying, *going into the science behind it has allowed me more room to explore my own spirituality.* When describing the meaning SDN holds in their life, one participant articulated it as, *a very broad aspect of my humanity,* going on to say, *it's just an integral part of human nature… an essence of life.* Whether of a spiritual nature, or in a broader context, study participants concurred that SDN was a catalyst for significant transformation in their lives.

Discussion

"Our brains renew themselves throughout life to an extent previously thought not possible"
(Gazzaniga, 2019, para. 5).

In this chapter, we interpret the findings of our study within the context of existing research. First, we examine how our findings relate to the literature. Then, we share unanticipated findings. Finally, we consider the implications of the study and how they pertain to the self-directed neuroplasticity (SDN) community, holistic health, the broader community, and future research. We end this chapter with our conclusion.

Findings Supported by the Literature

In this section, we first discuss the reasons participants cited for using SDN and how they align with the existing literature. We then explore the progression of participants' SDN practice over time, particularly regarding challenge-related consistency and resistance. Finally, we introduce the role of volition in our theme of *Empowerment*.

Reasons for using self-directed neuroplasticity. Our study participants described using SDN for reasons similarly addressed in the literature. Reasons include addressing stress (LeBois et al., 2015), anxiety (Weber & Taylor, 2015), depression (Segal, Williams, & Teasdale, 2002; Teasdale et al., 2002), smoking cessation (Westbrook et al., 2013), and food issues (Papies, Barsalou, & Custers, 2012; Papies, Pronk, Keesman, & Barsalou, 2015). Multiple studies also demonstrate the effects of self-directed approaches on cerebral function related to emotional regulation (Goldin, McRae, Ramel, & Gross, 2008; Plat et al. 2015; Ochsner, Bunge, Gross, & Gabrieli, 2002; Schardt et al., 2010; Sripada et al., 2014; Vanderhasselt, Baeken, Van Schuerbeek, Luypaert, & De Raedt, 2012). Additionally, literature exists on how mindfulness can counteract negative thoughts associated with negativity bias (Frewen, Evans, Maraj, Dozois, & Partridge, 2007; Kiken & Shook, 2011).

Progression of practice. All participants described various elements influencing the progression of their respective practices that exist in the literature, particularly with respect to challenges. These elements include consistency and resistance to practice; how the more one practices SDN, the more automatic the benefits become; and the concept of neurons firing together wiring together. Regarding the challenges associated with practice, many conveyed features of consistency and resistance that correspond with the literature. For example, some discussed an *internal struggle* with maintaining a consistency of practice, whether due to *boredom* or *difficulty of practice*. Another expressed a struggle associated with *letting go of old belief patterns* while still another reflected on how *old thinking creeps in* even when practicing regularly. However, several participants indicated their practices became *easier over time.* Clearly demonstrated in these findings are mechanisms of Hebbian theory (1949) and long-term potentiation (LTP) (Bliss & Lømo, 1973; Lømo, 2003) which suggest that the more frequently neurons fire together, the more firmly they wire together. Schwartz and Begley (2002) also stress that the more consistently and frequently one uses SDN, the more automatic the benefits become.

Empowerment through volition. For all participants, SDN was empowering. Empowerment may be a direct result of our participants recognizing human volition. Our participants expressed the act of choosing deliberately and by thought alone as *taking the driver's seat of your own development*, *we're not fixed*, and *I have a choice to make every time I have a negative thought.* Multiple studies on volition validate the ability of humans to directly influence brain processes by choosing how to react to certain stimuli (Goldin, McRae, Ramel, & Gross, 2008; Lévesque, et al., 2003; Ochsner, Bunge, Gross, & Gabrieli, 2002; Platt et al., 2015; Schardt et al., 2009; Sripada et al., 2014; Vanderhasselt, Baeken, Van Schuerbeek, Luypaert, & De Raedt, 2012). Moreover, Schwartz and Gladding (2011) illustrate the significance and potential of volition in

the advancement of human empowerment as it allows one the freedom to choose how they want to self-direct changes in the brain. Participants may have subsequently reflected on empowerment because, as they saw results from their self-directed practices, they gained greater self-confidence in what they could accomplish on their own. One participant stated this evolution as *it's just an increased degree of confidence... kind of an ownership of your own life*. In addition to results consistent with the literature, we also uncovered several unanticipated findings.

Unanticipated Findings

Our study contains several findings that are not in the literature. We first outline how participants used SDN for an expansive range of issues not previously reported. Second, we further articulate the SDN practice context beyond practice-related challenges. Lastly, we discuss the life-changing transformation achieved through SDN use, including associated relationship growth.

Expanding uses for self-directed neuroplasticity. Although study participants highlighted a number of reasons for using SDN that were consistent with the literature, they also reported using SDN for a more expansive range of reasons. These additional SDN uses are heavily concentrated within the area of various physical concerns and include:

- Brain Fog

- Chronic Fatigue Syndrome (CFS)

- Chronic Inflammatory Response Syndrome (CIRS)

- Ehlers-Danlos Syndrome (EDS)

- Electromagnetic Field (EMF) Sensitivities

- Lymphedema

- Mast Cell Activation Syndrome (MCAS)

- Multiple Chemical Sensitivities (MCS)

- Postural Orthostatic Tachycardia Syndrome (POTS)

All participants described a point in their lives where they started looking for different ways to manage various concerns and challenges. Within the context of *Seeking*, our first theme, several participants recounted reasons for pursuing SDN that are consistent with Mezirow's (1978) transformative learning theory. The theory assumes the desire to change by examining the premises that motivate our thoughts, actions, and behaviors (Taylor & Cranton, 2013). "People need to be willing and able to engage in activities that have the potential to lead them to shifts in perspective" (Taylor & Cranton, 2013, p. 40). Statements such as, *it became kind of a personal quest* and *I feel like I can do better* were expressed by multiple participants, aligning with Mezirow's assessment.

Also evident for many participants was the occurrence of a "disorienting dilemma" prior to seeking *a new way*. Upon experiencing a traumatic event, one participant revealed, *I didn't know what to do when I woke up in the morning, it was so overwhelming...* Another spoke of SDN in the face of a major medical crisis, *that's my only option, that or die…* Disorienting dilemmas induce every conceivable emotion in individuals and often provide the impetus for us to critically reflect. In the face of a disorienting dilemma, our participants may have had an innate understanding that healing starts from within, rather than from an external process. What's more, after feeling oppressed either from limiting beliefs or the grips of a chronic health condition, they wanted an opportunity for self-determination, which ties into our second theme of *Empowerment*.

In addition to thematic and theoretical explanations, our contrasting findings from the literature may be due in large part to the general lack of SDN research conducted to date. Likely

in conjunction with the limited research regarding the use of SDN in treating various health maladies, SDN is seldom used in mainstream medical interventions. In addition, some of the health challenges reported by participants for SDN application still face substantial scrutiny and/or lack of acknowledgement by the mainstream medical community, including brain fog, CFS, and MCS. A number of the reported health challenges within our study such as MCAS, CIRS, and POTS also can be difficult to diagnose and require significant time to diagnose, if ever officially diagnosed. Furthermore, many of the health challenges identified appear in a small subset of the population, and therefore, typically are not allocated significant research funding. Finally, little awareness and education regarding potential contributions of SDN to improved health and wellbeing has permeated the holistic health arena. Consequently, SDN's use by holistic health practitioners to support optimal balance of the mind, body, and spirit appears to be quite limited—as does the any research of SDN by holistic health researchers.

Further articulation of practice context. Although many participants communicated features of consistency and resistance consistent with the literature regarding SDN practice challenges, we did not expect a significant number of other findings regarding overall descriptive context of practice. Importantly, our findings reveal SDN practices may span four additional contextual areas beyond practice-related challenges: multifaceted process, support from mentors and guides, appreciation of neuroscience, and advocacy. We next detail the unanticipated findings associated with each of these areas.

With respect to multifaceted process, numerous participants reported a more intense and rigorous practice at onset. While several participants initially implemented SDN for *crisis management*, they eventually transitioned to using it more proactively throughout the day. Others use SDN more frequently during difficult times. These findings may result from participants

realizing—and often seeing—improvement, which then fueled further confidence and momentum for continuing SDN practice. Previous improvements also may have invigorated some participants to increase the frequency of SDN practice when an especially difficult situation arose. By consistently applying mindfulness as part of SDN, participants likely would see ongoing crisis management as a potential problem and seek, via sustained practice, to prevent a crisis scenario from again emerging. Additionally, participants were building new, adaptive neural pathways associated with their SDN practice while pruning away old, maladaptive pathways (Hanson, 2011; Hanson, 2013; Schwartz & Begley, 2002; Schwartz and Gladding, 2011; Wimberger, 2014). Moreover, given their awareness of the neuroscience, they likely were aware of those processes occurring, further motivating continued practice. Many participants also operate from a holistic health mindset. As such, they generally seem to live with a whole-person focus on the mind, body, spirit, social connection, and environment. This mindset may explain why a number of them emphasized the importance of self-care and lifestyle factors, including proper sleep, nutrition, and exercise, within the SDN practice process—offering what one described as a *cascade of effects that just goes on, and then they just kind of start to work in a circle with each other* for proper brain function.

More than half of the participants specifically alluded to the importance of a mentor or guide in their SDN practice. Some indicated that only when they consulted with a coach or expert who specialized in their particular SDN practice, did they experience the full benefits of SDN. This finding may be explained in part by some participants' affiliation with SDN programs such as Neurosculpting®, DNRS™ and Faster EFT/Eutaptics® that have built-in coaching or mentoring options. Alternatively, awareness and access to coaching or mentoring may have been limited among individuals participating in prior research. Another possible reason for this

finding is the growing prevalence of health coaching. As was the case with our multifaceted-process discussion, numerous participants also embrace life from a holistic health mindset. Accordingly, they align with the concept of healing through support and relationship, as can be facilitated through a coach or mentor. Through previous holistic health experiences, they may have more readily recognized how a coach/mentor can help guide, encourage, and moderate when attempting to *work on the big step* where there may be a tendency to practice too aggressively. Finally, if any of our participants operate from the critical or constructivist paradigm, their co-creating of reality with a coach or mentor may have been more intuitive and foundational in nature.

Our findings also acknowledge that almost every study participant conveyed an appreciation for the neuroscience behind SDN, including how SDN provides *a new way to look at the subconscious* and *how the brain processes stress*. However, these findings are unanticipated, given no prior studies target SDN user's understanding of that science, nor of SDN efficacy among users who have/embrace this knowledge and those who do not. This may be due to the dominant post-positivist paradigm driving mainstream medicine. Similarly, this paradigm likely influences the minimal research conducted to date regarding the efficacy of SDN in general and, more specifically, the absence of any correlational or causal research regarding SDN user's understanding/appreciation of the neuroscience and its efficacy. Another possible reason for this finding may arise from the fact that our participants comprised a more highly educated group and demonstrated a high-level of cognitive functioning. In addition, a number of participants come from a science background, so they likely are predisposed to *geek out over this stuff*.

Finally, we did not anticipate observing such a high degree of study participant openness to and enthusiasm for participating in interviews and sharing their personal experiences about SDN. As detailed in the Results chapter, participants consistently displayed excitement about the research project . Many participants additionally inquired about the project's completion timeline and accessibility for review. Furthermore, most of our participants expressed a desire to share the benefits of SDN in order to *pay it forward* or as a means of *helping others help themselves*. Advocacy for SDN among our participants extended beyond family and the *passing down to the next generation* of beneficial information, to include acquaintances, wider audiences, and even strangers. One participant stressed that SDN should be *part of teaching* and *taught as classes in elementary and high school* in addition to being just *stuff you should learn from your parents*. A possible reason for this advocacy of SDN may be enveloped in participants simply wanting to share what they found to work. Rationale for this finding may also be explained by the thematic emergence of *Empowerment* (facilitating heightened self-determination and confidence in sharing), *Growth in Relationships* (nurturing greater empathy for others), and *Transformation* (fueling increased energy and momentum regarding self, others, and the value of SDN). Moreover, participant exuberance may be a specific, interrelated outcome of the themes that consistently emerged among all participants through their lived experiences with SDN. For example, as part of their growth in relationships, several participants expressed experiencing an increase in *empathy* while another felt more *trust* in others and the ability to *form deeper relationships and connections*. Additionally, every participant reported experiencing powerful transformative qualities through their SDN practice such as *giving me a new life* and *becoming who you are,* which may have prompted the excitement and inquiry consistently displayed. From a paradigmatic standpoint, participants and researchers operating from the critical paradigm also

may feel allopathic medicine doesn't have all the answers. Therefore, they may possess a strong

desire to advocate for additional options. Alternatively, the dominant paradigm of allopathic

medicine that embraces the idea of needing something done to oneself versus finding healing

within seemingly has given little attention to promoting such advocacy in treatment or related

research. Closely related, this unexpected finding may be attributable to the lack of funding

currently allocated to creating awareness and related advocacy for SDN practice.

    Life-changing transformation through SDN. The current literature lacks an articulation of

SDN's potential transformative qualities. Consequently, the life-changing transformation

unanimously reported by study participants was a noteworthy unanticipated thematic finding.

Participants may have reflected on this transformation due to substantial improvements to overall

wellbeing in a relatively short period of time. A significant change in an abbreviated timeframe

is more noticeable than a slow, steady improvement over years. For those suffering from

debilitating chronic conditions, rapid improvement in health affected all areas of life, leading

participants to declare SDN created *a new life* and *saved my life.* These participants may have

reflected on transformation because they previously had been resigned to the idea they would be

sick for the rest of their lives and were appreciative of the improvement in their health. As one

participant said, *Previously, it was really just a continuous... vortex of getting worse and worse*

and worse... and then starting the retraining, it's really been... other than that one dip, it's been

just improvement. And… that is, that's totally different. Mezirow (1978) believes an internal or

external life crisis or major life transition triggers transformation. Once fully or partially

recovered from the effects of the disorienting event, one might actively engage in reflective

discourse, looking to establish meaning and validation from the experience (Mezirow, 1991).

Following this rational discourse, Mezirow (1991) says, "…learners conduct a critical

assessment of their epistemic, socio-cultural, or psychic assumptions" (p. 168). The fundamental

processes of critical reflection and critical discourse experienced and articulated by our

participants contributed to their transformation.

This life-changing transformation may also be explained in part by the changes various

participants experienced in relationships, as evidenced by our third theme, *Growth in*

Relationships. Regardless of their reasons for using SDN, each participant reflected on a change

in relationships with others. Growth in relationships may tie to the concept of only being able to

control one's self. Once one relinquishes the idea that they cannot control the behaviors of

others, it may allow the freedom to accept others as they are, therefore creating a better relational

dynamic. Furthermore, SDN requires greater self-awareness, which may lead to a growing

overall awareness, empathy, and understanding of how one interacts with others. One participant

stated as such: *I respond to other people differently. I treat other people differently. And in return*

they treat me differently as well. Finally, each participant noted dramatic changes in themselves,

with one participant describing it as, *I know that when I change, that… the whole relationship*

will change, and another as, it *changes the energy... around you to other people.* This change

may have acted as both a catalyst for change in relationships and overall personal

transformation.

Implications

Based on the expansive SDN uses, broadened SDN practice context, and SDN's life-

changing transformational qualities revealed in this study, we examine the implications of this

research beyond these findings. Specifically, our study has implications for the SDN community,

holistic health, general community, and future research. We next detail each of these

implications, starting with the SDN community.

SDN community. Many participants in our study described mixing modalities to customize their SDN practice for a plethora of challenges, including a number of modalities not reflected in current literature. Additionally, each participant reported implementing SDN differently, with most participants using SDN every day, several times throughout the day, while others use SDN on an as-needed basis. Numerous participants also believe a mentor or guide serves as a valuable resource for their SDN practice. In addition to benefiting early practice, several other participants conveyed that this guidance and support is particularly beneficial when attempting to *work on the big step* where there may be a tendency to practice too aggressively. Some further indicate it wasn't until they consulted with a coach or expert who specialized in their particular SDN practice that they felt they experienced the full benefits of SDN. One participant went as far as to say, *coaching was a huge, huge part of self-directed neuroplasticity working* to overcome limiting beliefs that prevented progress.

Our findings intimate that SDN experts/leaders first have tremendous opportunity to create potentially higher-efficacy SDN tools to further investigate and proactively link elements of various SDN modalities that show improved efficacy when used in combination. Experts and leaders have additional opportunity to increase awareness and further educate SDN community members regarding the expansive uses for SDN, variety of modalities and combinations, frequency of practice, and the potential for enhanced SDN efficacy via mentors and guides. To increase baseline awareness, we suggest SDN leading experts, trainers, and other providers integrate this information into the marketing of both SDN practices and related services through their websites, social media, email campaigns, and public relations. These individuals could further educate SDN users and potential users for deeper understanding through one-on-one client consultation, as well as additional, deeper, and more extensive workshop/conference

educational programming, website, and social media content. Given the enthusiastic advocacy for SDN evidenced in our study, we also suggest tapping into existing SDN users as much as possible to build greater credibility for its practice, in tandem with awareness building. In addition to this specific implication for the SDN community, our research revealed numerous implications associated with broader holistic health.

   Holistic health. Little research exists regarding the value of SDN within the holistic health arena. Consequently, our findings regarding reasons for using SDN, descriptive context of practices, and themes uncover several important considerations for educating holistic health practitioners and enabling them to further assist clients on their respective healing journeys. As mentioned in the SDN community discussion, how participants describe their use of SDN extends far beyond what currently is available in academic literature to address an extensive range of additional challenges.

   Because of its reported positive impact on our participants' health and wellbeing through mind, body, spirit, and social connection, we suggest SDN be included as part of holistic health curricula at colleges and universities. More specifically, our findings support the integration of content outlining the range of SDN modalities and expanded uses, applicable neuroscience, practice processes (including the importance of self-care and other lifestyle factors), potential challenges, and the role of mentors and guides. Opportunity also exists to educate students regarding SDN's ability to act as a catalyst for achieving greater personal empowerment, relationship growth, and life-changing transformation. Similarly, health coaching certification training programs could incorporate SDN concepts to more thoroughly educate prospective health coaches regarding the mind's ability to change the brain and ultimately facilitate greater self-determination regarding health and wellbeing, as well as transformative change. For existing

health coaches, integrating SDN training concepts into coaching approaches may enhance efficacy with clients during and between coaching sessions. Finally, holistic health organizations and holistic health practitioners could introduce SDN concepts during one-on-one client sessions, as well as within holistic wellness programs, conferences, and workshops. Given the consistent advocacy for SDN our participants demonstrated, current SDN users may serve as an excellent resource within various holistic health settings for helping convey the experiential components of practicing SDN, as well as elevating the credibility of SDN among individuals seeking to optimize their wellbeing via additional holistic health modalities.

General community. From both policy and local perspectives, our research project is particularly significant for the greater community. Regarding education policy, we believe SDN offers considerable value as a potential component of a whole-school student learning approach for kindergarten through high school. Embracing mental health and wellbeing as essential to a supportive school environment, this approach promotes students learning and success through opportunities to cultivate resilience-building strengths and coping skills. Critical components of this approach include family and community relationships, as well as curriculum and management (Weare, 2000; Wyn, Cahill, Holdsworth, Rowling, & Carson 2000). As an example, administrators and teachers should incorporate SDN concepts and experiential opportunities into age-appropriate curriculum, including science-based elements, training, and ongoing practice for both students and educators. In addition, community educators could weave SDN concepts and practice opportunities into children's after-school programs. Individuals also could leverage SDN techniques when coaching extracurricular school activities. Incorporating concepts within adult community education programming provides another impactful vehicle for introducing SDN at the local level.

In addition to our research mirroring academic literature regarding the use of SDN to treat a range of mental and emotional issues, every participant described powerful transformative qualities of their SDN practice—backed by dramatic changes mentally, emotionally, and physically. Consequently, we believe health policymakers should substantially elevate awareness and education among mental health professionals and other allopathic medicine providers regarding SDN, as well as encourage its use as an alternative intervention. In addition, for many of those experiencing chronic illness, they often are (or feel) alone with no or few answers. In many instances, these individuals also face exorbitant expenses associated with medical appointments, medicines, therapies, etc. In response, health insurers should consider providing insurance coverage for SDN programs, as well as employing and offering SDN-trained health coaching services for policyholders (as part of policy coverage). Finally, employee wellness programs may be more successful if they included SDN concepts and practice fundamentals, as well as employed SDN-trained and practicing wellness program facilitators.

Future research. This research project fills a gap in the literature by bringing forward foundational information regarding the lived experience of individuals using SDN. In addition to the lack of previous study about this topic, relatively little research has been conducted about SDN overall. Therefore, we believe our findings reveal a significant number of implications for future research. These implications include the need for evaluating the efficacy of SDN among individuals experiencing single versus comorbid health challenges, as well as among those who are chronically ill versus those who are not. In discovering that various self-care/lifestyle factors enhanced SDN's effectiveness for a number of our participants, we recommend researchers further study the effects of such factors, including nutrition, exercise, sleep, and nature. Moreover, research regarding the efficacy of SDN among users who understand and embrace the

related science versus those who do not could prove beneficial. We also suggest pioneering research be initiated regarding SDN's use as an intervention across a broader range of health challenges than those currently described in the literature. Finally, we recommend expanding research of SDN to larger quantitative studies in order to generate more generalizable information across a range of populations (e.g., general, gender-specific, various lifespan stages, marginalized populations). Within this quantitative framework and given the short time horizons associated with SDN research to date, we also believe longitudinal studies would be beneficial to more definitively assess SDN's long-term efficacy.

Conclusion

Neuroplastic change occurs throughout the lifetime in response to any stimulus, thought, or experience (Bach-y-Rita, 1972; Eriksson et al., 1998; Jenkins et al., 1990). Self-directed neuroplasticity entails actively and intentionally engaging the mind to change the brain by relying on the principles of neuroplasticity, Hebbian theory, and the quantum Zeno effect (Schwartz & Begley, 2002, Schwartz and Gladding, 2011). Although the concept of a plastic brain is not a recent discovery, academic research regarding SDN is still emerging. Moreover, no research describes the lived experience of individuals engaged in various SDN modalities. Through our phenomenological research framework and inductive thematic analysis, four themes emerged: *Seeking*, *Empowerment*, *Growth in Relationships*, and *Transformation*. Each theme helps explain, in part, various anticipated and unanticipated findings. Our findings indicate that SDN is used for reasons that include, yet far exceed, those documented in the literature. Similarly, SDN's descriptive practice context extends beyond those challenge-related features of consistency and resistance conveyed in prior research to further encompass a multifaceted process, support from mentors and guides, an appreciation of the neuroscience, and advocacy.

Finally, participants unanimously reported a significant yet unexpected finding: life-changing transformation through SDN.

Our findings both validate existing literature regarding several aspects of SDN while introducing a more expansive range of uses, broader descriptive context of practice, and its ability to fuel life-changing transformation. Consequently, they also strongly evidence the need to expand SDN awareness, education, and integration within the SDN community itself, holistic health, and the greater community. This research project fills a gap in the literature by bringing forward foundational information regarding the lived experience of individuals using SDN. However, given our findings, coupled with the limited research conducted to date, we strongly suggest additional SDN study. We recommend future SDN research target a wider range of health challenges, quantitative design approaches to garner generalizable information across various populations, and longitudinal studies to better assess long-term SDN efficacy.

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Appendix A
Research Recruitment Materials

Letter template for customizing and emailing to self-directed neuroplasticity experts:

Dear [Name of self-directed neuroplasticity expert]

We are graduate students in the Master of Arts in Holistic Health Studies program at St. Catherine University, Saint Paul, Minnesota. Currently, we are conducting a research project for our master's thesis: *A Phenomenological Study of the Lived Experiences of Individuals Practicing Self-Directed Neuroplasticity*. Through this study, we hope to advance the academic literature by conducting interviews to describe individual lived experiences regarding self-directed neuroplasticity.

We certainly recognize [customize paragraph to specific contributions of SDN expert] to the self-directed neuroplasticity arena. Consequently, we are writing to request your help in recruiting 12-18 participants for our study. Inclusion criteria for the study include individuals 18 or older, currently using self-directed neuroplasticity techniques for at least 90 days, and able to conduct an interview in English. We will conduct in-person or virtual (e.g., Skype/Zoom) 60- to 90-minute interviews. Finally, study participants will receive $25 "thank you" gift cards upon review of their respective interview transcripts.

Are you willing to help us recruit study participants by providing our recruitment flyer to your clients for their consideration (e.g., posting the flyer on your website), emailing possible participants and asking them to forward it to anyone who might be interested, and/or passing this request on to other professionals who might also be able to help with recruitment? If helpful, we would be happy to have a brief discussion with you regarding our project. To further assist in your decision-making, we also can provide you with a list of interview questions that will be asked with each study participant.

Our passion for this research project emerges, in part, out of our own experiences with self-directed neuroplasticity. Consequently, we look forward to advancing the knowledge and understanding of these practices. We are confident that your support of participant recruitment will facilitate such advancement. Please feel free to contact us at 952-797-3596 or by email: tjklein@stkate.edu. We look forward to hearing from you!

Respectfully,

Beth Kendall, NTP
Tim Klein
Theresa Tougas, RN

St. Catherine University
Henrietta Schmoll
School of Health

[Attach Recruitment Flyer]

Facebook Group Script:

Are you rewiring your brain? If "YES," check out our flyer for an exciting upcoming study! We are grad students conducting a research project on how people experience self-directed neuroplasticity (neural retraining). We want to hear your stories, perspectives, and experiences—so please consider participating! Upon completion of your participation, we'll provide a $25 Amazon gift card as a thank you. Train on, friends!

[Attach Recruitment Flyer]

Appendix B
Recruitment Flyer

Are You Using Self-Directed Neuroplasticity To Rewire Your Brain?

If "yes," we invite you to participate in a research study.

The purpose of the study is to describe the "lived" experiences of individuals using self-directed neuroplasticity. The mind's capacity to change the brain has been used to successfully address a wide range of challenges. However, seemingly no research describes the actual experiences of those engaged in this practice.

What's expected?

- Participation in one 60- to 90-minute interview.
- Participation in the interview either in person or via virtual technology (e.g., Skype/Zoom).
- Review of your interview transcript.

ST. CATHERINE UNIVERSITY
Henrietta Schmoll
School of Health

To be eligible, you must be:

-18 years of age or older

-Currently practicing self-directed neuroplasticity for at least 90 days

-Able to participate in an in-person or online interview in English

___

Self-directed neuroplasticity entails:

✓ Awareness of thoughts & actions
✓ Focused attention on redirecting thoughts & actions
✓ Consistent efforts to change thoughts & actions

___

$25 Amazon gift cards are available as a "thank you" for your participation!

If interested in participating or need more information, please contact the graduate students in the Master of Arts in Holistic Health Studies at:

SDNPResearch@gmail.com

Appendix C
Participant Consent Form

ST. CATHERINE UNIVERSITY

Informed Consent for a Research Study

Study Title: Changing Brains, Changing Lives: Researching the Lived Experience of Individuals Practicing Self-Directed Neuroplasticity

Researchers: Beth Kendall, B.S., NTP, Tim Klein, B.S., and Theresa Tougas, B.S.N., RN

You are being asked to participate in a research study. This study is entitled: *Changing Brains, Changing Lives: Researching the Lived Experience of Individuals Practicing Self-Directed Neuroplasticity.* The study is being done by Beth Kendall, Timothy Klein, and Theresa Tougas, Masters' candidates in the Master of Arts in Holistic Health Studies program at St. Catherine University in St. Paul, MN. The faculty advisor for this study is: Carol Geisler, Ph.D., Associate Professor, Master of Arts in Holistic Health Studies at St. Catherine University.

The purpose of this study is to describe the lived experiences of individuals using self-directed neuroplasticity. This study is important because very little research on the topic of self-directed neuroplasticity exists. In addition, there seemingly is no research that describes the personal experiences of people using self-directed neuroplasticity. Approximately 12 to 18 people are expected to participate in this research. Below, you will find answers to the most commonly asked questions about participating in a research study. Please read this entire document and ask any questions you may have before you agree to be in the study.

Why have I been asked to be in this study?

You have been identified as someone who uses or has used self-directed neuroplasticity for a minimum of 90 days, are at least 18 years old, and able to participate in an online or in-person audio-recorded interview conducted in English. We consider self-directed neuroplasticity to include any practice that incorporates:

- Awareness of thoughts & actions
- Focused attention on redirecting thoughts & actions
- Consistent effort to change thoughts & actions

If I decide to participate, what will I be asked to do?

If you meet the criteria and agree to be in this study, you will be asked to do these things:
- Review and sign consent form (10 minutes).

- Participate in an interview about your experiences with self-directed neuroplasticity. Interviews will take place in a public space with privacy such as a library or conference center or, if virtual, a private room (60-90 minutes).
- Review an electronic copy of the transcript of your interview for accuracy and transparency within 1 week of the interview (20 minutes).

In total, the entire process will require approximately 90-120 minutes.

What if I decide I don't want to be in this study?

Participation in this study is completely voluntary. If you decide you do not want to participate in this study, please feel free to say so, and do not sign this form. If you decide to participate in this study, but later change your mind and want to withdraw, simply notify any research team member and you will be removed immediately. You may withdraw until 1 week after you review your interview transcript, after which time withdrawal will no longer be possible. Your decision of whether or not to participate will have no negative or positive impact on your relationship with St. Catherine University, nor with any of the students or faculty involved in the research.

What are the risks (dangers or harms) to me if I am in this study?

While the likelihood is low, there is a risk of breach of confidentiality and privacy of your data. We will take special precautions in safeguarding your data by storing paper documents in a locked file cabinet. In addition, we will protect all electronic documents with passwords. Only the research team and our advisor will have access to your identifiable information. Once we are done analyzing your data for the study, we will destroy all identifiable information. Because the interviews are conducted face to face or via virtual modality, we cannot guarantee complete anonymity.

While none of the questions we plan to ask require you share information about painful or distressing experiences, answering interview questions may trigger emotions or uncomfortable sensations. You may ask to stop at any time during the interview. In addition, we will provide you a handout detailing available psychological services should you want to seek help after the interview.

What are the benefits (good things) that may happen if I am in this study?

We cannot guarantee that you will experience any direct benefits from participating in this research; however, your participation may lead to potential advancement in the academic literature regarding self-directed neuroplasticity.

Will I receive any compensation for participating in this study?

While you will not receive compensation for your time in this study, you will receive a $25 gift Amazon card as a "thank you" for participating. The gift card will be provided to you following completion of both the interview and your review of your interview transcript.

What will you do with the information you get from me and how will you protect my privacy?

The information that you provide in this study will be audio recorded and subsequently transcribed (written out word for word.) The researchers will combine the information we gather from your interview with each participant's respective information to determine if any themes emerge that capture the experience of using self-directed neuroplasticity. We may use direct quotes from your interview in our final written analysis. Your name will be removed from the data. We will keep the research results in a locked file cabinet and any electronic data will be kept in password-protected file on a password protected computer. Only we and the research advisor will have access to the records while we work on this project. We will finish analyzing the data by July 31, 2019. We will then destroy all original reports, including audio recordings and identifying information that can be linked back to you. We will keep all de-identified data indefinitely.

Any information that you provide will be kept confidential, which means that you will not be identified or identifiable in the any written reports or publications. If it becomes useful to disclose any of your information, we will seek your permission and tell you the persons or agencies to whom the information will be furnished, the nature of the information to be furnished, and the purpose of the disclosure; you will have the right to grant or deny permission for this to happen. If you do not grant permission, the information will remain confidential and will not be released.

Are there possible changes to the study once it gets started?

If, during the course of this research study, we learn about new findings that might influence your willingness to continue participating in the study, we will inform you of these findings

How can I get more information?

If you have any questions, you can ask them before you sign this form. You can also feel free to contact any one of us at SDNPResearch@gmail.com. If you have any additional questions later and would like to talk to the faculty advisor, please contact Carol Geisler at 651-690-7789. If you have other questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you may also contact: Dr. John Schmitt, Chair of the St. Catherine University Institutional Review Board, at (651) 690-7739 or jsschmitt@stkate.edu.

You may keep a copy of this form for your records.

Statement of Consent:

I consent to participate in the study and agree to be audiotaped. My signature indicates that I have read this information and my questions have been answered. Also, I am aware that even after signing this form, I may withdraw from the study up to one week after reviewing my transcripts by informing the researcher(s).

_____

Signature of Participant   Date

_____

Signature of Researcher   Date

Please return the statement of consent to SDNPResearch@gmail.com after signing in one of three ways:
1. Electronic signature
2. Print, hand-sign, and scan back
3. Sign consent, take a picture, and email it to us

Appendix D
Interview Guide

A Phenomenological Study of the Lived Experiences of Individuals
Using Self-Directed Neuroplasticity: Interview Guide

Demographic Information About Participant (Questionnaire):

"Before we begin with the interview questions, we would like to know a little more about you. To protect your privacy, we also ask that you provide us with a pseudonym—a name other than your own to use when we discuss your answers."

What is your preferred pseudonym? _____

"We will now begin the audio-recording."

"In conducting this study, we want to discern as much as possible about your lived experiences with self-directed neuroplasticity and what those experiences mean to you. Again, we consider self-directed neuroplasticity to include any practice that incorporates awareness of thoughts and actions, focused attention on redirecting thoughts and actions, and consistent effort to change thoughts and actions."

How long have you been practicing self-directed neuroplasticity? _____

What kind of self-directed neuroplasticity are you using? _____

How frequently do you engage in self-directed neuroplasticity? _____

What have you used self-directed neuroplasticity to address?
_____

Interview Questions:

Our research question is: *What are the lived experiences of individuals using self-directed neuroplasticity?* To answer this question, we will be asking six open-ended questions. When asking these questions, we specifically are interested in hearing about your unique experiences with using self-directed neuroplasticity.

1. Tell us a bit about yourself and what led you to self-directed neuroplasticity?

2. Please describe how you use self-directed neuroplasticity?

3. How would you describe your experience or experiences with self-directed neuroplasticity?

4. What changes, if any, have occurred in your life since you began using self-directed neuroplasticity?

5. What meaning do these changes hold for you?

6. Is there anything else related to your lived experience of self-directed neuroplasticity that you'd like to share?

Field Notes:

In addition to collecting demographic and interview-specific verbal data, we will take field notes to record nonverbal, contextual data which may not be sufficiently captured via the audio recording—i.e., what is heard, seen, experienced, and thought over the course of each interview. These notes will include observations/reflections pertaining to:

1. Body language

2. Facial expressions

3. Changes in voice, including volume and tone

4. Hand gestures

5. Demonstrated emotions

6. Interpersonal interaction

Handwritten and informal, the field notes will be recorded during each interview by the research partner, as well as after each interview during a 15-minute reflection by both the lead interviewing researcher and research partner. The field notes will be recorded in research notebooks maintained by each researcher. Because the information contained in the field notes is sensitive, they will be secured in a similar manner (i.e., a locked cabinet) as the audio recordings and transcripts.

Field Notes Documentation Form

Date:	Interviewee Pseudonym:
In person Virtual	Lead Interviewing Researcher and Research Partner:

For each question, document non-verbal content such as facial expressions, speech rate/rhythm volume, body languages, pauses/length of silence.

Question 1:

Question 2:

Question 3:

Question 4:

Question 5:

Question 6:

Final reflections:

Interview Checklist

Lead Interviewing Researcher/Research Partner:

Participant (Pseudonym):   In-Person or Virtual Interview
                                                                                    (circle one)

Place (if in person):

Pre-Interview Checklist:
- ☐ Arrive to the interview location thirty minutes prior to the scheduled interview time.
- ☐ Find and prepare interview space. If using Skype, Zoom, or other virtual technology, confirm software application is accessible and working.
- ☐ Prepare documentation (e.g., interview questions, demographic questionnaire, psychological resources).
- ☐ Check audio recording device recording ability and battery.
- ☐ Conduct a grounding activity to include a brief self-reflection focused on recognizing and then letting go of any potential influences on the interview, setting an interview intention of openness, and then engaging in a "clearing" three-minute breathing space meditation.
- ☐ Welcome interviewee and re-introduce lead interviewing researcher and research partner.
- ☐ If meeting in person, bring the interviewee to interview space.
- ☐ If applicable, obtain signed consent form.
- ☐ Highlight key elements of consent form and ask interviewee to confirm her/his verbal consent of participation by stating "yes."
- ☐ Outline interview process, including discussion of:
    - o Audio-recording procedures and note taking
    - o Emphasize that if the interviewee experiences discomfort at any point during the interview, or doesn't want to answer a question, she/he just needs to inform the interviewing researcher. In such instances, we can proceed to the next question or terminate the interview.
    - o Highlight psychological resources if she/he feels stressed from interview.
- ☐ Whether in-person or virtual, the interviewing researcher and research partner should audio-record the interviewee's responses to each question from the demographic questionnaire *after* the interviewee provides a pseudonym.

    Before we begin with the interview questions, we would like to know a little more about you. To protect your privacy, we also ask that you provide us with a pseudonym—a name other than your own to use when we discuss your answers. What is your preferred pseudonym?

- ☐ After researchers document the pseudonym provided by the interviewee, start the audio recording. Using the following script, the interviewer first should state the purpose of the demographic questions and then ask each question:

In conducting this study, we want to discern as much as possible about your lived experiences with self-directed neuroplasticity and what those experiences mean to you. Again, we consider self-directed neuroplasticity to include any practice that incorporates awareness of thoughts and actions, focused attention on redirecting thoughts and actions, and consistent effort to change thoughts and actions.

1. *How long have you been practicing self-directed neuroplasticity?*

2. *What kind of self-directed neuroplasticity are you using?*

3. *How frequently do you engage in self-directed neuroplasticity?*

4. *What have you used self-directed neuroplasticity to address?*

☐ Before starting the actual interview, remind the interviewee that her/his story is what we seek throughout the interview.
☐ State the importance of remaining on topic and responding to as many questions as possible.
☐ Hold an expectation of interviewee to respond to a major share of the questions for the interview to be considered complete.
☐ Upon completion of these steps, start the interview with the lead interviewing researcher using the scripting and questions below. Additional probing questions are to be initiated first by the interviewing lead researcher with additional probing-question support provided by the research partner.

Our research question is: 'What are the lived experiences of individuals practicing self-directed neuroplasticity?' To answer this question, we will be asking six open-ended questions. When asking these questions, we specifically are interested in hearing about your unique experiences with using self-directed neuroplasticity, so the questions provided are only to guide our discussion.

1. *Tell us a bit about yourself and what led you to self-directed neuroplasticity?*

2. *Please describe how you use self-directed neuroplasticity?*

3. *How would you describe your experience or experiences with self-directed neuroplasticity?*

4. *What changes, if any, have occurred in your life since you began using self-directed neuroplasticity?*

5. *What meaning do these changes hold for you?*

6. *Is there anything else related to your lived experience of self-directed neuroplasticity that you'd like to share?*

Additional notes (research partner documents in her/his research notebook):

Post-Interview Checklist:

☐ Initiate an interview debriefing: *"We've completed the interview questions. Before we finish, is there anything else you would like to add, or is there anything you would like to ask about?"*

☐ Highlight the key points from the interview and be open to feedback. When the interviewee has finished providing any additional feedback, conduct a final "consent" check-in: *"Being grounded in ethics, we as researchers, want to take the extra step of re-confirming your consent to this interview. Do you confirm your consent?"*

☐ Finalize the interview debriefing, and then shut off the audio recording device.

☐ Check with the interviewee to determine how she/he is feeling, including whether she/he is feeling psychological distress.

☐ Provide interviewee the *Psychological Services* handout. If it is a virtual interview, the handout will be emailed to interviewee. In addition, emphasize action to undertake if she/he experiences psychological concerns after leaving the interview.

☐ Communicate the next steps of the interview process (i.e., our transcription timeline, follow-up forwarding of the transcript to study participant for review/approval confirmation, provision of "thank you" Amazon gift card after her/his transcript review/approval confirmation).

☐ Ask the interviewee if she/he has any other questions regarding the interview or overall interview process.

☐ Wrap up the interview with a statement of gratitude for participation: "*Thank you very much for participating in this interview. We really appreciate your time. And most important, your responses are valuable in understanding more about the experiences of individuals using various self-directed neuroplasticity. It was an honor to hear your story."*

☐ Following the interviewee's departure, allocate 15 minutes of tranquil, uninterrupted time for interview reflection.

☐ Document reflections in research field notes (including reflection on interviewee's voice, facial expressions, body language, hand gestures, interpersonal interaction, etc.).

☐ The interviewing researcher will collect field notes and identifying hardcopy documentation to securely store in locked file or cabinet. The interviewing researcher also will download the audio file of the recorded interview, creating an electronic file. (Any electronic data, including audio files, will be secured in-password protected documents and uploaded to our password-protected university Google drives.)

Reflection Notes (to be documented by both researchers in their respective research notebooks):

Appendix E
Psychological Services

A Phenomenological Study of the Lived Experiences of
Individuals Using Self-Directed Neuroplasticity

Psychological Services

If the research interview causes any psychological distress, please know mental health resources are available to assist you. Specific resources are provided below. Any psychological care for injuries resulting from this research should be paid by you and/or your insurance company. If you think you have incurred a research-related psychological injury, please immediately contact the research team at SDNPResearch@gmail.com.

Twin Cities Metro Services	Contact Information	Description
NorthPoint Health & Wellness Center	1313 Penn Ave N. Minneapolis, MN 612-543-2500	Sliding fee scale. Walk-in and scheduled appointments available
Family Tree Walk in Clinic Counseling	1619 Dayton Ave. #205 St. Paul, MN 651-645-0478	Provides free walk-in appointments, donations accepted

National/International Services	Contact Information	Description
Crisis Hotline/National Suicide Prevention Lifeline Network	800-273-TALK (8255)	Free 24/7 Crisis Hotline
National Crisis Text Line	Text TALK to 741-741	Text a trained crisis counselor 24/7 (free)
Befrienders Worldwide	www.befrienders.org	Provides free assistance in finding a counseling helpline (by country)