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Neuroplasticity Knowledge and Perceived Self-Efficacy in Western Adults: A Qualitative Examination

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Self-efficacy is described as people's beliefs regarding their capabilities to produce designated levels of performance that affect their lives and is considered important for self-regulation of mental health disorders. Biofeedback has demonstrated that knowledge of one's physiology can help regulate mental health disorders, such as anxiety (McKe, 2008). Neuroplasticity is defined as the capacity for the brain to rewire its structure and create new neural pathways to make up for lost functions due to brain injury. There is limited research in how neuroplasticity can be used as an agent for behavioral change. This qualitative study examined if knowledge of the brain's malleability may affect adults' perception of self-efficacy in recovery from evolutionary-based mental health disorders, with an aim to lay a foundation of general themes for further quantitative studies. Following 12 interviews, themes were recorded regarding perceived self-efficacy at time points during mental health recovery from an adult group who was knowledgeable about neuroplasticity versus a group which wasn't knowledgeable. In addition to other differences, the Superordinate theme of will was mentioned 64 times across the Knowledgeable group, versus only 11 times in the Non-knowledgeable group. As variations between the groups were perceived, future quantitative research may determine if educational programs can assist adults who are turning to self-regulation as a means for recovery from said afflictions.
Keywords: neuroplasticity, neural plasticity, self-efficacy, biofeedback, CBT

In the modern day, evolutionary traits can either positively or negatively intersect with cognition, which may lead to ailments such as addiction, anxiety, or depression. These evolutionary attributes (which once served us when human survival meant encountering a greater number of potential physical dangers), can contribute to displacement of thoughts, or attention, generating obstructive ideas or sensations when no physical threat exists (Rossman, 2010). In contemporary times, without the same level of external threats for these responses to usefully react to, humans are faced with the task of regulating their thoughts.

While addiction, anxiety, and depression may arise due to several factors (Ducci, 2012), this study focuses on the perception of one's ability to self-regulate addiction, anxiety, or depression (while operating under the assumption these afflictions have arisen as result of mismanagement of evolutionary traits). The study explores how awareness of the brain's biological plasticity may assist in the perception of one's ability to manage their cognition to improve their day-to-day experience. The supposition asks if adults with knowledge of neuroplasticity may generate a higher perception of self-efficacy through understanding that the brain is a malleable organ, and how their perception of self-efficacy may vary from those without knowledge on this topic.

Background

For the past century, scientific evidence has supported the ability for individuals to change patterns in their cognition, and their behavior despite the traits we may have inherited through evolution. Some successful models of management include:

- **Metacognition:** A term used for "hyper awareness" over one's thoughts which can be used as a learning tool when it comes to completing a task (Flavell, 1979).
- **Cognitive behavioral therapy (CBT):** Originally developed by Aaron Beck to utilize thoughts, feelings, and behaviors in conjunction with one another for self-regulation (Beck et al., 1979).
- **Biofeedback:** A method that has been designed to monitor mental health issues, such as anxiety through observation of physiological metrics (McKee, 2008).

Neuroplasticity refers to the brain's ability to rewire its neural pathways when injury occurs, or its ability to generate a novel syntax following the completion of an action. Studies in neuroplasticity have demonstrated that structural changes in the brain is biologically possible, even in adulthood. Brain malleability has been utilized in recovery from loss of functions due to brain injury or damage (Doidge, 2007). However, neuroplasticity has yet to be explored as a tool to assist in behavioral change as related to mental health concerns. Bandura, who coined the term "self-efficacy" (a term used in psychology today), described the term as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives." (Bandura, 1994, p. 71).

Due to the perceived success of recovery and/or management of addiction, anxiety, or depression

through CBT, biofeedback, and metacognition, this study examines if adults with knowledge of their biological makeup may have a stronger perception in their ability to self-regulate their recovery from the above-mentioned (possibly evolutionarily induced) mental health afflictions. This study will review how the above mentioned methods (CBT, biofeedback, metacognition) have aided behavioral re-programming to support this supposition. This study also asks if it may be worthwhile to further research if those who are aware of the brain's biological ability to change in adulthood, may utilize this knowledge to cognitively enhance their sense of self-efficacy when it comes to recovery from said afflictions.

The Mind & Evolution

In a lecture at University of California, psychologist Martin Rossman (2010, 3:55) was quoted saying that humans have been born with faculties in our brains, that as far as we know, don't belong to any other creature on earth, allowing us to evolve from a vulnerable prey animal to the dominant creature on earth. As human evolution, spanning millions of years, has carried changes to our environment, it has brought subsequent biological progression with it. Dr. Beth Kurland (2018) explores how evolution of our species has included certain advantages that were once incredibly useful, but do not serve much purpose in a modern setting. These attributes still affect the way our thoughts, and even behavior functions today (Kurland, 2018). In a contemporary setting, each of these evolutionary traits can contribute to the afflictions of addiction, anxiety, or depression.

Studies have demonstrated that certain substances can cause people to over-evaluate their rewards by disrupting our working memory while creating temporal myopia (Schultz, 2011). This tendency stems from what Kurland (2018) calls "the finger trap dilemma," referring to a desire for humans to avoid unpleasantries (such as a snake). This desire which used to assist us while living in the wild, may enable us to proactively search for escape from discomfort through indulgence in things such as addictive substances (Kurland, 2018). Rolls and Cowey (1970) captured data from both captive and semi-free-ranging rhesus monkeys, and they found that monkeys displaying impulsive and aggressive behavior (traits which are seen to have been beneficial for our evolution), were also pre-disposed to addiction. It has also been argued that because substance abuse is linked to human's evolutionary traits (such as the reward system), it should be treated as a human tendency which requires management, as opposed to a disease which needs medical treatment (Saah, 2005).

When it comes to anxiety, Brosschot et al. (2016) detailed how an inherited stress response in humans that is always running in the background, is ignited when a threat occurs. This stress response allowed us to stay alert when we had fewer protections and greater threats (Rossman, 2010). To assist individuals with management of anxiety by providing metrics on what healthy levels of anxiety may look like, a signal detection framework was published in by Bateson et al. (2011).

A correlation (though not a causation), between symptoms of loneliness and symptoms of low mood has also been perceived, while detailing the evolutionary theory of loneliness (Cacioppo et al., 2006). Research across several studies has been gathered to demonstrate how depression can help with problem solving as an adaptive feature (Andrews & Thomson, 2009) as depressed moods help us to target and avoid exclusion from social groups, which is a danger when it comes to survival, particularly in the wild (Badcock et al., 2017). Given the remnants of these traits, it may be natural for adults to experience the sensations of addiction, anxiety, or depression in our ever-changing environment, requiring on-going management through models which are accessible to them.

Evolutionarily-Based Mental Health Disorders and Access to Healthcare Today

In recent decades, addiction, anxiety, and depression have been on the rise in the West (North America and Europe). According to a study conducted by Hidaka (2012), a quantitative measure of modernization and lifetime risk of a mood disorder trended toward significance ($p = .060$) which may be attributed to a country's GDP per capita, the growing number of long-term illnesses as a result of changing environments, and increased levels of loneliness. It has been reported that up to 33.7% of the population in the modern day is affected by an anxiety disorder during their lifetime (Bandelow & Michaelis, 2015). It has also been recorded that there has been a surge in overdose deaths in the West related to addiction to opioids (Garg et al., 2019). Other studies have discussed the increase in difficulty to afford access to mental health care in the West due to inflation, a rise in demand for therapy leading to burnout from ther-

apists, and a lack of therapists in rural areas (Chan, 2022). With these trends, it's important for science to examine additional ways that adults can self-regulate experienced mental health symptoms, as access to clinical assistance isn't consistently available for all.

Digitizing mental health care in the modern day became more prevalent and accepted following the COVID-19 epidemic, which caused people worldwide to stay at home. A study examining digitalized mental health care cited Talkspace, an online therapy application which reported a 65% increase in clients following the epidemic (Gratzer et al., 2020). Furthermore, researchers have examined the increase in the use of social media as a tool to self-regulate mental health (Ozimek & Förster, 2021). An example is the Instagram channel @headspace, with over one million followers worldwide, which creates posts regarding the benefits of meditation, self-care, and more to help people at home with navigating their mental health experiences (Headspace, 2023). Continuing to digitize education surrounding psychology as a self-regulation tool may assist those who are suffering from the above-mentioned afflictions, with insufficient access to assistance in a clinical environment.

Neuroplasticity and the Brain's Ability to Change

In The Brain That Changes Itself, Dr. Doidge (2007) details how our neural pathways can be altered. If a neural pathway becomes damaged or blocked from an injury, the brain automatically searches for new connections for certain tasks or utilizes other paths to send signals. He also provides an example of people who become blind and are then able to enhance other sensations to complete a task. This is known as re-organization (Doidge, 2007).

Doidge's (2007) book details how the brain is the only organ that is capable of giving the owner a qualitative, subjective sensation and inner awareness. The sensation one has while eating gelato from Grom in the Latin Quarter of Paris will likely be different from the sensation one feels while living isolated with the flu in a London flat. Each conscious state has "a certain feel to it." The awareness of our sensations will be important later in this study.

Dr. Paul Bach-Y-Rita has done extensive work in the use of tongue sensors to treat balance disorders due to deteriorated vestibular functions. His findings show that re-calibrating the central nervous system through these sensors can improve patients' balance (Bach-y-Rita et al., 2005; Tyler et al., 2003). Dr. Pascual-Leone once said, "The system is not plastic, but elastic," meaning the brain could be molded and formed, but was unable to completely "snap back," to a previous iteration (Doidge, 2007, p. 209). Pascual-Leone's quote was demonstrated in a study where teachers of blind students were submerged in complete darkness for a week. At the end of the week, the teachers could decipher what kind of motorcycle was near to them by listening to the engines. When their blindfolds were lifted, they were completely disoriented. Pascual-Leone mapped their brains using transcranial magnetic stimulation. He then used the brain scans to perceive that the visual cortex had been used to process auditory signals (Pascual-Leone & Hamilton, 2001).

Based on Roll's experiment, Dr. Jeffrey M. Schwartz designed a study for his own patients with obsessive compulsive disorder (OCD). He introduced mindfulness into an OCD clinic and developed a four-step method, instructing patients to create real-time mental notes to obstruct the experience they were having with mindful commentary when they get caught up in compulsive thoughts. His findings were the following:

> Our PET scans had shown that the orbital frontal cortex, the caudate nucleus, and the thalamus operate in lockstep in undoubtedly the source of a persistent error-detection signal that makes the patient feel that something is dreadfully wrong. By actively changing behaviors, refusing changes which brain circuits become activated, and thus also changes the gating through the striatum. The striatum has two output pathways, as noted earlier, direct and indirect. The direct pathway tends to activate the inhibited cortical activity. Refocusing, I hoped, would change the balance of gating through the striatum so that the indirect, inhibitory pathway would become more traveled, and the direct, excitatory pathway would lose traffic. The result would be to damp the down activity of this OCD circuit (Schwartz & Begley, 2003, p. 85).

Following the completion of these studies, we better understand how the malleability of the brain may lead to recovery or improvement from certain neurological ailments and specific mental health afflictions, such as obsessive-compulsive disorder (OCD). It is

worth exploring if it may potentially do the same for evolutionarily induced mental health disorders which are currently regulated with use of biofeedback, metacognition, or CBT. We will explore the current understanding of these methods more in the following sections.

Biofeedback & Self-Regulation

Biofeedback is a process which measures physiological information that is displayed to patients so they can better attempt to control their symptoms. In the case of psychology, biofeedback is utilized for management of stress and anxiety, and requires patients who have a strong psychological awareness of their own symptoms. Patients have recorded physiological changes they've experienced during times of stress (such as sweating), demonstrating it is possible for notions of mind-body interactions to resonate with an individual (McKee, 2008).

Accurate feedback of performance facilitates the learning of any skill, not just when it comes to controlling physiological behaviors. It assists with everything from hitting a golf ball into the hole on the green to solving an algebra problem (we will observe this more in the section on metacognition). A person bowling with a blindfold on isn't as likely to make a strike – not only because they cannot see what they're doing – but because the visual feedback of their performance following an action informs their next attempt. For instance, if they visually recorded that the way they tossed the bowling ball forced it to go too much to the left, and therefore into the gutter, they know to straighten up their grip in the next round. For biofeedback to work successfully with patients, the patient must have the capacity to respond, be motivated, receive positive reinforcement from learning, and be provided with accurate information regarding the results of their learning. From biofeedback, we see the potential of observation when it comes to recovery from mental health issues, namely anxiety (McKee, 2008). In a study related to obesity reduction, Teufel et al. (2013) recorded an increase in self-efficacy following treatments of biofeedback in 31 women, however, additional studies would need to be conducted to statistically support this theory.

As science has recorded the benefits of observing our biology as self-regulation tool for mental health disorders, the author asked whether a similar methodology could be applied when it comes to neuroplasticity, training adults on the malleability of the brain, and testing their perception of self-efficacy before and after. Before designing a research proposal on this hypothesis, it was supposed that conducting a preliminary study on any key differences in themes between adults who are knowledgeable about neuroplasticity and those who aren't would be prudent. Through this initial, qualitative study, science can first assess if variation in perceived self-efficacy exists between those with knowledge of brain malleability and those without knowledge.

Metacognition & CBT

Metacognition is a term used for "hyper awareness" over one's thoughts. This concept has been developed in various ways since Aristotle, however, it is often associated with John Flavell who suggested that an awareness of control regarding cognitive processing of thoughts regarding learning was drawn from both metacognitive knowledge, followed by regulation (Flavell, 1979). To properly evaluate and monitor one's own learning, metacognition not only involves a patient thinking about what they've learned, but how they learned, in addition to examining their own learning process (Flavell, 1979). Flavell's 1979 work detailed metacognition into the various forms:

- **Content knowledge** (declarative knowledge): An understanding of capabilities, such as a singer knowing the strength of their vocal cords, or a salesperson knowing their memorization skills.
- **Task knowledge** (procedural knowledge): A perception of a tasks' difficulty based on the type of assignment, the length and what it entails.
- **Strategic knowledge** (conditional knowledge): The ability to strategize based on the available tools to learn.

Metacognition has recorded that using our cognitive thoughts in learning can improve performance in an array of ways. It has been found that self-questioning as a strategy to monitor and regulate perceived performance was effective (Child et al., 1998). Studies have also recorded a significant positive relationship between the use of Metacognitive Reading Strategies and mastery-approach goal orientation (Baker & Brown, 1984). The practices behind metacognition has led into CBT which is described by the National Health Service (NHS, 2023) as the following:

- CBT is based on the concept that your

thoughts, feelings, physical sensations and actions are interconnected, and that negative thoughts and feelings can trap you in a negative cycle.

- CBT aims to help you deal with overwhelming problems in a more positive way by breaking them down into smaller parts.

You're shown how to change these negative patterns to improve the way you feel. Unlike some other talking treatments, CBT deals with your current problems, rather than focusing on issues from your past. Evidence-based practice of CBT details that there are numerous empirical studies published regarding the success of this treatment for ailments such as addiction, anxiety, and depression, with literature on this topic from less than 2,000 studies, articles or books published in 1995-1999, to 14,000 in between 2010-2014. The three principles are defined by Dobson and Dobson (2017) as the following:

1. **Access hypothesis:** This means that thoughts are accessible to us and aren't unconscious.
2. **The mediation hypothesis:** This means that our thoughts are responsible for how we experience or feel about situations which surround us.
3. **The change hypothesis:** This means that by changing our thoughts we can change our behavioral or emotional response to certain stimuli or events.

Given the current research and understanding of CBT as a tool to regulate thoughts which then effect behaviors or emotions, this study questions if knowledge of the makeup of the brain itself may be used as a self-regulation tool within these methods.

Visualization, a Psychological Perspective

"Worry gets a lot of bad press because we don't use it very well." (Rossman, 2010, 3:44)

In his lecture, How Your Brain Can Turn Anxiety into Calmness, Dr. Rossman (2010) makes the case that imagination is the key mental faculty that separates humans from animals. Imagination allows humans to remember things from the past and project inventions or creative ideas into the future. It allows us to picture how reality may vary if we try things in different ways. Rossman argues that few of us have been taught the correct way to use our imagination. Empirical analysis designed by philosophers such as Aristotle have also contributed to the progression of society. For us to test a hypothesis and survey the results, we first must make observations, invent a scenario, then bring that scenario to fruition. In other words, without science, ideas are just ideas. But still, the scientific discoveries, prior to being tested, were ideas first

To examine how the imagination may manifest itself into action, Dr. Pascual-Leone (1995) conducted an experiment with piano players which demonstrated that visualizing playing the piano lit up the visual cortex in the same format as if one were actually playing it. In other words, when people close their eyes and imagine a simple object, such as the letter A, the primary visual cortex lights up, just as it would if the subjects were looking at the letter A. Imagining scenarios or outcomes also overlaps with the neural circuits required to complete the execution of an action (Agnati et al., 2013). With this knowledge, it is implied that visualization as a function of the imagination can improve performance–with a drawback being humans oftentimes visualize or imagine negative events or scenarios, partially due to our evolutionary faculties. While this study is preliminary research regarding cognitive awareness as it pertains to neuroplasticity, it is worth asking if holding knowledge of the brain's malleability may assist in the ability for one to imagine their brain changing physically, which will be further explored in the discussion section.

Criticisms and Gaps in Knowledge Regarding Neuroplasticity, Biofeedback, and Metacognition as Tools for Change

While neuroplasticity has been examined through several studies, its usage has mainly been applied regarding recovery from loss of brain function, or to assist with OCD. Research has supported that plasticity of the brain may be a key function into improving sensations of depression (Wilkinson et al., 2019), meanwhile, other studies perceived how various gray matter in the brain is responsible for the ability to learn as we age (Fischer et al., 2022). However, when it comes to the ability to form new pathways or connections, there are also no current experiments or papers which examine how knowledge of this capability may affect the perceived self-efficacy of recovery from the mental health issues of addiction, anxiety, and depression.

While biofeedback has been a successful tool when it comes to the monitoring of anxiety, it is costly and requires the patient to be in a certain place at a certain time, with specific facilities available. Biofeedback's in-

ability to scale is a hindrance to its overall success as a tool for recovery from mental health disorders, particularly given the earlier research cited regarding the growing trend to self-regulate mental health disorders in the West due to a lack of access to such facilities. Metacognition is a helpful practice when it comes to learning, but there aren't current searchable studies which function on its ability to change behavior.

Finally, certain research has perceived brain activity during visualization in its participants as well as some physiological effects, though it did not allow us to explore how associating cognitive thought with the power of imagination may relate to perceived self-efficacy in recovery from mental health afflictions (Chen et al., 2017).

Purpose of the Study

As a recap, science is aware of the following:

- Certain mental health afflictions are induced by evolutionary traits, and are rising in prevalence today, with an increasingly difficult access to healthcare in the West, leading to a growing tendency for adults to self-regulate mental health disorders.
- Cognitive awareness is an effective tool in the regulation from these evolutionarily based disorders through methods such as CBT.
- Observation of biology is also an effective tool in the regulation of evolutionarily based disorders, mainly anxiety through the method of biofeedback.
- It is biologically possible for the brain to form new neural pathways.

Science has yet to record if knowledge regarding the biological malleability of the brain may equip people with a higher sense of perceived self-efficacy when it comes to recovery, and/or management from these evolutionarily based-mental health disorders. The purpose of this study is to lay a foundation for the uses of neuroplasticity in conjunction with cognition and biological awareness and examine how these faculties may work with each other. This is an initial investigation into any potential associations between adults' knowledge in neuroplasticity and their belief in the potential for recovery from mental health afflictions. The three afflictions of addiction, anxiety, and depression were chosen as a focus as these disorders may be evolutionarily induced and therefore treatable through self-regulation. If these disorders are present in the modern day as a response to humans attempting to navigate a rapidly changing environment which our evolutionary fear responses cannot adequately adapt to, it is possible that utilizing cognitive awareness around the topic of neuroplasticity may be an agent of assistance. By examining the potential difference in themes between those who are knowledgeable regarding brain malleability and those who aren't when it comes to perceived self-efficacy for recovery from addiction, anxiety, and depression, the psychological community can determine if promoting knowledge regarding neuroplasticity to the general population can help with management of said disorders.

Should the findings of the interviews demonstrate themes that knowledge of neuroplasticity may correlate to one's perceived self-efficacy when it comes to recovery from these mental health disorders, there may be opportunity to explore how training people on the functions of the brain may help with their own self-regulation as a form of therapy. Scaling such training and education could potentially be more accessible and affordable than individual patients utilizing clinical assistance, such as CBT, or biofeedback sessions. The potential for knowledge sharing as a means of assisting with recovery from these disorders should be further explored after quantitative investigations, which would be dependent on the findings of this study.

Method

A foundational, qualitative study based on combining knowledge of neuroplasticity and cognitive awareness was created, aiming to perceive how these two components may correlate in adults with the mental health disorders of addiction, anxiety, and depression. In this preliminary investigation, the researcher examined potential associations between knowledge of neuroplasticity and a positive outlook on recovery from mental health issues with an objective to document initial research. The study utilized ground theory (Strauss & Corbin, 1994), reasoning that allowing themes to arise from the data may detail potential findings that justified resources for more extensive quantitative studies. This was decided following a non-conclusive search for published studies regarding this supposition.

Research Design

The research was carried out in 12 interviews total, across an adult population ages 25-71. Six participants who held general knowledge of the subject

of neuroplasticity were placed in the Knowledgeable group, while six who attested they had no general knowledge of the subject of neuroplasticity were placed in the Non-knowledgeable group. The aim of dividing the results into two groups was to examine the variation of themes (whether Superordinate or Subordinate) which arose between those with knowledge versus those without knowledge and to record any differences. Prior to the interviews, each of the participants filled in a survey which asked two questions detailed below to place them in the correct group. The exact questions sent in the survey are detailed below with the full survey detailed in Appendix B.

Survey Questions:

1. *Have you heard of the term neuroplasticity? (Yes/No)*
2. *Please rate your knowledge of neuroplasticity from 1-5, with 1 being little-to-no knowledge and 5 being an expert in the subject. (1,2,3,4,5)*

Participants who answered question one with "Yes," and question two with any rating of "two" or above, were placed in the Knowledgeable group. Once six participants for each group had been gathered, the interviews commenced.

Research Questions

Participants in both groups were asked the questions detailed below in a one-to-one interview with the researcher which was recorded and then transcribed. The questions chosen were the same across both groups as the aim was to see any general differences in the perception of one's ability to change and possibly recover from addiction, depression, or anxiety and then assess the different themes. The researcher did not ask about knowledge of brain malleability during the interview, as the goal was not to provoke an association between knowledge and the themes of recovery that the participants may not have had. By asking both groups the same set of questions and analyzing the themes afterwards, differences in the groups which existed regarding the overall sentiment towards recovery and the possibility for change in adults were able to be recorded. The full interview schedule with instructions can be seen in Appendix C.

- *Do you think that human beings can change habits once they become an adult?*
- *How much do you believe in the phrase, "You can't teach an old dog new tricks?"*
- *Do you believe people with mental health disorders such as addiction, depression or anxiety have a high potential to recover if they're provided with the right resources?*
- *On a scale of 1-5 with 1 being the lowest ability and 5 being the highest ability, how do you rate your own ability to change habits or behaviors you find are no longer serving you?*
- *What techniques do you use to change what you view as unhelpful behaviors?*
- *Is there anything else you'd like to add?*

Research Setting

All participants were interviewed remotely using Microsoft Teams via an invitation sent out using the researcher's BPP University sponsored email account c.agonis@my.bpp.com.

Participants

The inclusion criteria for participants required that they were over the age of 18 (therefore in the adult category) and weren't part of a known vulnerable group within that category (such as those with a learning disability). The questions asked were focused around the participant's views on the ability to recover from addiction, anxiety, and depression, and didn't examine active recovery from these afflictions. Therefore, there was no mental health criteria utilized in recruitment. Those who expressed verbally or in writing that they may be part of a vulnerable category were excluded, as this study was a preliminary investigation on the general adult population to lay a foundation for further studies and wasn't set to examine those of a particular vulnerable group. Participants were chosen from countries within North America and Europe, as the research conducted for the study pertained to Western trends and practices. Of the 12 participants sampled, the demographics included two male-identifying adults and 10 female-identifying adults, ages 31-71 residing in the UK, USA, and Switzerland. The full table of participant characteristics can be viewed in Appendix A.

Procedure & Data Collection

Each participant was recruited using the researcher's personal Instagram account (@chixonthehud) and Facebook page (dallas_athent). The full advertisement text was pre-approved by BPP's ethics community prior to posting, and is detailed below:

Slide 1: As many of you know, I'm currently obtaining my MSc in Psychology at BPP University. For my dissertation, I'm running a study on self-efficacy for recovery from mental health issues in adults.

Slide 2: I will be interviewing participants regarding their perception on the potential to recover from mental health issues, and examine if that has any correlation with knowledge of neuroplasticity.

Slide 3: If you'd like to help me by partaking in the study, please submit your email here and I will email you additional information. You do not need to have knowledge about neuroplasticity. We need participants for both the study group and control group. Thank you all.

Participants were accepted for the study regardless of if they knew the researcher personally. The only utilized criteria is that listed above in the participants section. Once interest was expressed via the Instagram and Facebook posts, participants were emailed a consent form via the researcher's BPP University email address (c.agonis@my.bpp.com) which asked them if they consented to participate in the study and informed them they could withdraw any time without consequence. The consent form provided the basic outline of the study and a breakdown of the kinds of questions that were to be asked. It detailed that the study was run as part of the researcher's MSc in Psychology and that the researcher was a student at BPP University. The full consent form and information sheet sent to the participants can be viewed in Appendix D.

Upon receiving the participants' signed consent forms, participants were then sent the survey detailed above in this document's research design section using the Microsoft Forms account connected to the researcher's BPP University email address. The survey notification informed the participants it was capturing their email addresses for the purposes of adding them to the Non-knowledgeable group or Knowledgeable group. Once the groups were formed, the participants were emailed virtual appointment options held on Microsoft Teams which were recorded and saved (audio only) in the researcher's password protected BPP University SharePoint account, with no personal information included. Participants were advised prior to recording to turn off their cameras for additional privacy. No identifiable information was shared in any interview recording including names. The recorded interviews were then transcribed using Sonix, and permanently deleted once transcription had concluded. The participants were notified via email upon deletion of the recordings.

Interview Process

To ensure consistency across the interviews, each participant was interviewed by the author of this paper. Each participant was asked a set of pre-defined questions during the interviews, which can be seen in Appendix C. These questions were not altered across all 12 interviews, nor were they re-ordered. If the participant only gave a short answer, (such as only a few words), the interviewer would ask them what they thought of when they heard the word "resources" following question three, in order to generate additional insight. All participants were able to speak at their own desired length to each question.

Ethical Considerations

Ethical considerations for this study were low, as all participants were adults over the age of 18 and weren't part of a known vulnerable group. In the information sheet provided prior to the interviews, candidates with any mental health issues they felt could be affected by partaking from the study were encouraged to withdraw, which was also shared with the participants verbally prior to the interviews being recorded. During the recording process of the interviews, the researcher ensured not to use any of the participants' names so that they would not appear in any transcripts. The study conducted was not experimental, meaning there was no intervention throughout the interviews. During the study and in line with the BPP University Ethics Committee, participants were notified that they could opt out at any time throughout the study, including during the interview.

Data Analysis

Following the transcription of all interviews, the transcripts were analyzed using Thematic Analysis (TA) using the steps outlined by Braun and Clarke (2006). TA was the chosen process for reviewing the results of this study, as the process of the researcher familiarizing themselves with the material via several read-throughs ensured thorough examination of potential underlying themes. Additionally, using TA would also allow for replication of this study, or further analysis of the interviews already conducted by additional parties, who can continue to iterate on the transcribed interviews if necessary. In a qualitative analysis, TA involves a process of pre-determining themes and searching for codes in the research which may support or negate those themes, or reading each transcript several times, and marking each expression of a thought, feeling, idea or association made by a participant as a "code" (Byrne, 2021). This study took

the second approach. Once the codes were marked, common themes emerged from the data. Themes were not proactively searched for in the process and were only determined following the coding process. In an example from Participant's 8 interview, two codes were marked in the sentence "I think there is capacity (code 12) to change both depending on just where you are on the spectrum of your brain's ability (code 13) and what's left of it," as they both expressed a thought, feeling, idea or association. The first expression that was coded was that there is capacity to change, and the second was that there was a *neurological component* related to this capacity. A full example of the coding process and following TA can be seen in Appendix F.

A quantitative measure was added to the thematic analysis, with the frequency of each mentioned code being recorded to heighten each code's prevalence within their respective themes. To promote consistency, all codes listed in the results were transcribed in their original form and were not used as placeholders for other terms. Ambiguous sentences were interpreted within context following several read-throughs by the author of this paper and researcher, Catherine Agonis, who remained the sole reader of the results throughout the study. How the researcher's own experience may have affected these interpretations are detailed in the reflexivity statement below. As the researcher is aware that having one reader may result in a potential bias in the analysis of the results, they have included a sample analysis in the appendix, which is color coded, for review. The researcher can also be contacted to release the transcripts of all 12 interviews should peers wish to examine their contents for further analysis. Once the interview transcripts were printed, read, and the codes were marked, they were organized in a Google Sheet utilizing various tabs for each theme.

To begin the thematic analysis, the interviews were first broken into two groups, the Non-knowledgeable and Knowledgeable groups. The researcher then familiarized themself by reading each transcribed interview three times. Codes that were mentioned more than once have been marked with the count number in their respective tables denoting the number of times mentioned. The amount of mentions also affected the importance of the code for the overall theme, as it was supposed that if a code was mentioned more than once in an interview, or across multiple interviews, it was held in higher regard to the speaker. The top themes with the most code "counts" were then selected as the Superordinate themes, and the rate of frequency from which the theme was mentioned was denoted. Any codes or themes not related to the key themes were considered outliers and removed from the analysis. To ensure consistency in the analysis of the codes, the researcher conducted all the reviews using Braun & Clarke's (2006) TA structure. The researcher reviewed the four most frequently mentioned Superordinate themes per each group, in addition to the key overall themes mentioned, as recommended by Eval Academy in this kind of thematic analysis (Jones, 2022).

Reflexivity Statement

As an individual who grew up in the USA in the 1990s, I understand I am personally used to "finding a solution" to my own issues and tend to be "solutions oriented" when an uncomfortable experience arises. During my upbringing, the USA maintained a "pull yourself up by your bootstraps" culture, in conjunction with the notion of the "American Dream." Both sentiments induced not only a belief, but a pressure on citizens to "make it" at all costs and persevere no matter the background or experience. This is demonstrated in pop culture of the era, including Hollywood films such as Forest Gump and superhero comics such as Spiderman which tell stories regarding individuals who found triumph despite all unlikely adversaries, largely due to the accepted, innate goodness and strength of their persona. These narratives (some realistic and others clearly fantasy), shared a different message than that of media from other periods, such as the Victorian age. An example of a popularized narrative whose aesthetics varied from that of contemporary times would be Edith Wharton's Summer, (1917) which ends tragically for the heroine despite all her efforts to live "truthfully" as a single woman during a time where marriage was considered of utmost importance. With the influx of positive messaging in the USA during the 1980s-early 2000s, it felt accepted by society that if you "really pushed and tried," and "had a magical touch," you could make anything happen.

In addition to the cultural surroundings, the household of my upbringing lacked a comparatively large presence of an authoritative figure compared to that of my peers. Learning to self-govern potentially gave me a personally higher sense of perceived self-efficacy as I never believed designated authorities were to credit for my success (nor my failures). With this said, there's the

possibility that my position in this study, which examines perceived self-efficacy, was influenced by my general position that I personally hold will and influence over my own behavior and the subsequent outcomes.

Additionally, as it pertains to the review of the codes, it should be noted that I was raised speaking American-English, which may hold a different analysis than an individual of a different English-speaking country, as Americans have the tendency to be more expressive, thereby potentially reducing the perception of the implied intensity when it came to the interpretation of particular thoughts.

Results

Identified Codes & Themes

To begin the thematic analysis, the participants were put into one of two groups, those being the Knowledgeable group and the Non-knowledgeable group. The findings for both groups are listed below, with breakouts for Superordinate themes and Subordinate themes particular to each group. Several of the codes were related to themes which did not have enough total mentions to substantiate inclusion in the results. For instance, within the Non-knowledgeable group, the theme of the perception of biology playing a major role in one's ability to change was mentioned only 10 times across all six of the interviews. Codes related to this theme, and this theme itself were removed.

Common Themes Across Both Groups

In order to assess the themes respective to the Non-knowledgeable group versus the Knowledgeable group, the themes were coded separately and then combined into common Superordinate themes where there were major alignments. The three Superordinate themes which overlapped are discussed in this section, and are listed and detailed as the following in Table 1:

- The day-to-day environment is a key factor in one's ability to change.
- The possible techniques one can utilize range from medical to holistic.
- Overall, one's ability to change their behaviors or recover from addiction, anxiety or depression is not only possible, but promising.

On average, the length of the interviews for the Knowledgeable group were 18% longer than the Non-knowledgeable group with an average of 1278 words spoken in the former group versus an average of 1052 in the latter. The Knowledgeable group's extended length of average interview times meant that certain themes were mentioned with greater frequency, as the topics were discussed at longer intervals. What these metrics may indicate will be examined more in the discussion section.

The Day-To-Day Environment Is a Key Factor in One's Ability to Change

Both groups of participants recorded one's environmental surroundings as a key contributing factor to their ability to change. Environmental factors mentioned were access to basic needs, access to varied experiences, and access to mental health resources. This theme had a total of 83 code mentions across all 12 interviews.

Sub-Theme: Community, Family, Friends and Having a Person Is a Key Component to Recovery. "Having a person," whether that person was a partner, family, chosen family or friends, was reported as a needed element to an individual's direct surroundings to support change from both groups of participants, as seen below.

> Interviewer: When you think of the resources, what does it look like to you? Participant 1: Okay. So, in the very beginning, the support of your immediate circle, whether that's family or chosen family. (Participant 1, Non-knowledgeable group)

When discussing available resources that assist with recovery accessible within one's environment, Participant 1 named support from family first. Partner-related comments were made 26 times within the Knowledgeable group, versus 13 times in the Non-knowledgeable group. In some cases, such as in Participant 10's statement below, the perceived potential of assistance from loved one's was also dependent on the ability of a person to keep a relationship, indicating there is an element of responsibility on the individual to ensure that resource is available.

> But, you know, family resources and friend resources and the ability to develop relationships and friendships is an important resource, which is very much based on the individual. (Participant 10, Knowledgeable group).

It was unclear from the interviews what correlation knowledge of neuroplasticity (if any) may have to a stronger belief in perceived self-efficacy if human connections are also formed.

Possible Techniques One Can Utilize Range from Medical to Holistic

Perceived techniques mentioned to help people change habits or behaviors ranged from medical (namely attending therapy and use of prescribed medications), to holistic (such as taking part in meditation). This theme's codes had 70 mentions across all 12 interviews. Two sub-themes regarding techniques were mentioned frequently across both groups as discussed below.

Sub-Theme: Therapy. It was reported across both groups that therapy was a helpful component to recover from mental health afflictions with some participants also mentioning medication in conjunction with seeking professional help. This indicated that institutionally supported assistance was relevant to recovery, regardless of perceived personal capabilities. Therapy was mentioned 17 times in the Knowledgeable group, and six times in the Non-knowledgeable group.

> Quote 1:
> Interviewer: And what do you think the kinds of resources that should be provided are?
> Participant 2: Firstly, as many forms of therapy as possible, like cognitive behavioral therapy, for example. (Participant 2, Non-knowledgeable group)
> Quote 2:
> My first thought is therapy when I hear resources. (Participant 9, Knowledgeable group)

Similarly to Participant 10 who viewed access to support from family and friends as a key resource within one's surroundings, Participants 2 and 9 associated therapy as a technique one can turn to which could be used to aid recovery. The prevalence of therapy in discussions across both groups demonstrated an overall belief that professional assistance was a key factor for change, regardless of knowledge of brain malleability.

Sub-Theme: Writing / Journaling. In both groups, several participants described using writing and journaling to assist with improving behaviors and advancing past bad habits. Participant 1 expressed that the process of writing helped assist them in knocking off small intentions throughout the day.

> I actually have to write it down. If I put it on my phone, I'm less likely to have completed it. I don't know why I have to write it. (Participant 1, Non-knowledgeable group).

As Participant 1 shared, a greater level of satisfaction occurred when writing-by-hand was involved. Participant 9 expressed the satisfaction they received by crossing things off a to-do list or seeing their intentions written on the page, sharing a similar sentiment to Participant 1 of writing and/or journaling as a useful technique inconsequential to levels of neuroplasticity knowledge.

> My biggest thing that I do is bullet journaling, and so I've done habit trackers in there where like for example, one thing that I really wanted to start doing a few years ago was to make sure to always read something before I looked at my phone in the morning and something that I tracked where I wrote out the days of the week and I put a little dot for every day that I did it, and it just felt very satisfying to look when there were a lot of dots. (Participant 9, Knowledgeable group)

While this sub-theme had arisen between both of the groups, its presence wasn't related to the thesis question at large.

One's Ability to Change Their Behaviors or Recover From Addiction, Anxiety or Depression Is Not Only Possible, but Promising

All 12 participants expressed they believed change was possible when it came to the mental health afflictions of addiction, anxiety, and depression, in addition to a disbelief that one is unable to change habits once reaching adult age. In referring to the colloquial phrase "You can't teach an old dog new tricks" as "nonsense," Participant 3 expressed a disbelief that adulthood hindered one's ability to update their programming.

Similarly, negative reactions to this phrase were present across all participants. Additionally, when asked at the beginning of the interview "Do you think that human beings can change their habits once they've become an adult?", all participants responded affirmatively regardless of which group they were in, alas, no difference in this sentiment was recorded between the groups. However, sentiments of positivity were expressed with greater prevalence in the Knowledgeable group. In total, this theme received 64 mentions across 10 interviews, with 41 mentions in the Knowledgeable group versus 23 in the Non-knowledgeable group.

Non-knowledgeable Group: Particular Themes

Following the initial analysis, the Non-knowledgeable group generated 90 codes which were collated into eight Superordinate themes. Each of the Superordinate themes were ranked according to the

number of total codes mentioned with repeated codes counted towards the total. After additional re-reads of all interviews, the list of codes was reduced to 66 out of the original set of 90. Codes which did not relate to an overall theme, and were therefore outliers, were removed. A recount of the codes within each theme was completed, allowing deduction to four major themes with linked Subordinate themes. The breakdown of final codes can be seen in Table 2. While three of these Superordinate themes were included in the overall theme group and discussed above, this paper will highlight the Superordinate themes and Subordinate themes particular to the Non-knowledgeable group in this section so their differences from the Knowledgeable group may be discussed for additional analysis.

Changing One's Behavior Is Possible Through Activity

Despite having no knowledge in neuroplasticity as demonstrated by the participants' surveys, the participants in the Non-knowledgeable group each attested to a belief or understanding that the brain is a malleable object whose structure can be altered through a repetition of actions or activity. This theme had a total of 39 codes mentioned across six interviews.

Sub-Theme: Introduce Randomness. Participants in the Non-knowledgeable group recorded the need for an individual to attempt to introduce varied experiences into their own surroundings independent of the immediate offerings of their environment to aid their ability to change behaviors. The call to action in Participant 3's statement below utilized an understanding of evolution as an exploration of how randomness helps us evolve on a macro-level.

> The more randomness you introduce, the higher your probability is that you will find an experience that teaches you something meaningful or that will lead to change. I think that's how biology evolves, right? It doesn't know what a good gene is, so it just keeps changing its genes and the good genes survive. And yeah, I think that that can be taken for human behavior as well... Reading a book is randomness...Traveling is randomness. (Participant 3)

The scientific outlook, despite claiming no knowledge of neuroplasticity, took an empirical approach towards personal advancement. It has the potential to be linked to the environmental Sub-theme described later in this section.

Sub-Theme: Repetition as a Driver for Change. Several participants within the Non-knowledgeable group mentioned how the repetition of tasks as a practice could eventually induce a new pattern from a person who is looking to alter their behavior. For example, Participant 5 described a belief that dedicating oneself to a conscious repetition led to an acceleration towards self-improvement despite claiming no knowledge regarding brain malleability and the ability to reorganize or create new pathways through activity via this study's survey.

> And you continue to proceed forward as a different human. It takes constant practice and control. (Participant 5)

Where this supposition stemmed from was unclear and will be examined further in the discussion section.

(The Day-to-Day Environment Is a Key Factor in One's Ability to Change) Subordinate Theme: Varied Surroundings

Participants in the Non-knowledgeable group brought up diversity and exposure to varied experiences as a key factor in one's environment which will help them to change. These mentions were different from the codes related to the Subordinate theme of "introducing randomness."

> I think observations play a huge role, and if you've never had a chance to observe an improved version of a state, then you might just not know that that is something that could be improved or something that can even change if you've never seen a change. If you grow up in a broken household where I don't know, the parents are always arguing, the relationship is toxic and you're never exposed to a positive relationship, it is possible that you just don't have the observation to know that good relationships are possible. (Participant 6)

Via this quote from Participant 6, it is possible that the idea of benefiting from varied surroundings is linked to the idea of introducing randomness. Both express a need for diversity to advance improvement, with the above comment leaning more towards the general environmental factors outside of a person's control as a resource, and the introduction of randomness through activities such as reading and travel as a technique within an individual's authority.

Sub-Theme: Privilege. Participants in the Non-knowledgeable group mentioned privilege when

it came to access to basic human needs including healthcare, housing, and time as affecting one's ability to change. I feel like I'm privileged enough to have the resources to make any change that I choose to make. (Participant 3)

As Participant 3 implied, their own privilege was seen as a factor in their ability to alter their habits. It was indicated from participants without knowledge regarding the brain's plasticity that environmental factors, which may be out of a person's control, may affect their perception of self-efficacy when it comes to recovery from these disorders.

Knowledgeable Group: Particular Themes

Following the initial analysis, the Knowledgeable group generated 280 codes which were collated into seven Superordinate themes. Each of the Superordinate themes were ranked according to the number of total codes mentioned with repeated codes counted towards the total. After additional re-reads of all interviews, the list of codes was reduced to 192 out of the original set of 280. A recount of the codes within each theme was completed, allowing deduction to four major themes with linked Subordinate themes. The breakdown of final codes can be seen in Table 3. While three of these Superordinate themes were included in the overall theme group and discussed above, this paper will call out Superordinate themes, and the Subordinate themes particular to the Knowledgeable group in this section.

Will Is a Key Factor in Changing Behavior

The participants in the Knowledgeable group recorded the importance behind individual will when it comes to recovery from mental health afflictions or unhelpful behaviors. Numerically, this was the most expressed theme between any group, with 62 total mentions across six interviews, and the highest frequency of mentions across all interviews with one mention per 0:50 minutes on average. While this theme was also raised in the Non-knowledgeable group, the total mentions were 11, ranking it below other more commonly mentioned themes and excluding it from the overarching themes from that group. The difference in mentions highlights the relevance of this theme to the Knowledgeable group.

Sub-Theme: Positive Mindset. Participants in this group recorded that maintaining hope, positivity and/or an intrinsic outlook towards "the glass being half-full" assisted in their perception of self-efficacy when it came to behavioral change. An example was expressed by Participant 7, who shared a belief that a solution is always available.

> I think intrinsically it's the hope, like the everyday will bring something new. Every day there is always a chance to modify whatever is being like in the past. There is always a solution. I'm 100% convinced. There is always a solution for everything. (Participant 7)

While none of the participants linked a positive mindset with knowledge of the brain's malleability, the concept of "keeping positive" as an agent for change was demonstrated more frequently within this group.

Sub-Theme: Although Possible, Change Isn't Easy and Takes Effort. Mentions regarding the amount of effort required to induce change were sometimes linked to the desire of the individual. Participants in this group called on the reality that change is a process, which requires personal dedication and intention.

> I would say that's completely based on your openness and receptiveness to changing behaviors. I think that that's a really difficult thing to change in somebody subconsciously if they're not open to it themselves. (Participant 8)

In addition to discussing the effort required from an individual to recover from addiction, depression, or anxiety and/or change their behavior, Participant 8 indicated that improvement efforts were characteristic.

Sub-Theme: Openness. Several participants in the Knowledgeable group shared that an individual's ability to changed was linked to a personal openness to do so. There wasn't a recorded trend regarding what the participants believed led to openness.

> Interviewer: And how much do you believe in the phrase you can't teach an old dog new tricks?
> Participant 8: For dogs or for people? [Laughter]
> Interviewer: I guess it's a phrase for people.
> Participant 8: I definitely don't believe that at all. I think if the dog is open to learning new tricks, then the dog handler can teach it new tricks, yeah. (Participant 8)

While records such as Participant 8's demonstrated a belief that the ability to change in adulthood stems from an individual's openness, it is unclear how this may be linked to knowledge of brain malleability. (Additionally, it is important to note that while responding, the Participant was laughing, leading to an interpretation that they were playfully joking about the analogy referring to dogs. Due to the non-verbal reactions during the interview, it

was supposed that the Participant was continuing to speak about the dog as an analogy for humans.)

The Possible Techniques One Can Utilize Range From Medical to Holistic-Subordinate Theme: Self-Awareness

Participants in the Knowledgeable group detailed the need for cognitive self-awareness as a requirement for one to change.

Quote 1:

I think it takes a lot of work and self-awareness, but yeah, I think it's absolutely possible. (Participant 11)

Quote 2:

I think there has to be an awareness of whatever it is that you want to change. (Participant 12)

Although the knowledgeable group detailed a need for self-awareness of one's issues in order to change, it was not indicated in how that self-awareness can be obtained, nor how this may be linked to knowledge of brain malleability.

Comparison of Groups

Despite the Non-knowledgeable group attesting to having no knowledge regarding neuroplasticity, a belief that change in one's behaviors was possible, as well as their ability to recover from addiction, anxiety, and depression was recorded in all six interviews from this group. This belief was equally expressed in the Knowledgeable group, demonstrating that perception regarding the ability to change and recover existed. Originally, when assembling this study, it was supposed that the sentiment regarding the possibility of change would be more affirmative with the Knowledgeable group versus the Non-knowledgeable group, meaning the Non-knowledgeable group would thematically indicate change wasn't always possible for adults. However, these findings recorded that regardless of knowledge as it relates to neuroplasticity, the participants believed that the potential to recover from mental health disorders in individuals is present, and no difference in this point of view was perceived across the two groups (for instance, no participants responded to the question of the ability to change negatively). In total, the theme, "Overall, one's ability to change their behaviors or recover from addiction, anxiety or depression is not only possible, but promising," received 64 mentions across 10 interviews, with 41 mentions in the Knowledgeable versus 23 in the Non-knowledgeable group. While the overall sentiment remained consistent, the greater number of mentions in the Knowledgeable group is worth examination as it pertains to this supposition and demonstrated a variance in prevalence from the Non-knowledgeable group.

Of the original list of Superordinate themes, "Childhood development as a key-factor in one's ability to change" was mentioned throughout both groups, but less frequently than the final Superordinate themes selected, leading to its exclusion in the final Superordinate themes list. It was originally presumed that those who believed childhood events and experiences grossly affected one's ability to change may have a lower sense of perceived self-efficacy when it came to the possibility of recovery, as this theme may imply a deterministic outcome set by the first few years of our lives. The theme of development (which oftentimes cited childhood upbringing or trauma in this study) insinuated that recovery is more difficult once we reach adulthood as we are coded from a young age. An example of this would be from Participant, 2, who stated, "Your ability to do that is the direct result of trauma. So, people who have suffered trauma fall into some behaviors to either self soothe or survive, and so I think those things are hard to change."

Of the Knowledgeable group, the theme of development was mentioned 22 times across six interviews, and from the Non-knowledgeable group it was mentioned 17 times across six interviews. It was first suspected during the original read through of the transcripts that the equality of this theme's importance across both groups demonstrated a corresponding sense of perceived self-efficacy despite the presence of knowledge. This was due to the theme of change being possible arising as a Superordinate theme in both groups, and development being a less mentioned theme in both groups. However, upon the second screening of the Superordinate themes across groups, key differences emerged and were noted.

Firstly, the importance of will and self-determination in an individual was the major theme in the Knowledgeable group, with more mentions and a higher frequency than any other theme across both groups. Within the Knowledgeable group, this theme was mentioned 62 times, as opposed to the Non-knowledgeable group who mentioned it only 11 times, excluding it from an overall Superordinate theme for the Knowledgeable group

while being excluded in the final list of Superordinate themes for the Non-knowledgeable group.

Self-efficacy is defined as an individual's belief in their ability to complete behaviors or tasks to attain a certain performance (Bandura, 1977). From the study's metrics and definitions described, it is worth further investigation if those with knowledge of neuroplasticity may also believe that a person has a higher ability to change if they have the will to do so. A link between will and perceived self-efficacy may possibly imply that ability to recover from the mental health disorders of addiction, anxiety, and depression via this capability lies more under their control than under other outlying factors, but this would need to be examined further.

When it came to the Superordinate theme of "Environment playing a key role," beliefs in how the environmental factors influenced one's ability to recover from mental health disorders varied across the Knowledgeable and Non-knowledgeable group. For the Non-knowledgeable group, the environment's sub-themes included an acknowledgement of privilege regarding having access to basic needs, such as housing and healthcare, possibly indicating that the ability to change is affected by external factors as opposed to internal ones. Factors of basic needs were not recorded in the Knowledgeable group, meaning the Subordinate theme of privilege did not arise. The presence of this Subordinate theme in the Non-knowledgeable group, versus the presence of the Subordinate theme of will in the Knowledgeable group, signaled a variation in the perception of what is within one's control versus out of one's control.

It was also found that despite not having formal knowledge regarding neuroplasticity, the Non-knowledgeable group believed that the brain was "re-codable" or malleable through action. While contemporary science largely steers away from nativist claims, it may be implied from the records of the Non-knowledgeable group that an innate understanding potentially exists regarding brain malleability. This is worth further consideration separate from this study. It is unclear where exactly this understanding stemmed from, and whether it was assumed or taught to these participants under some other name, or induced through subliminal, cultural messages (such as the popularization of sayings like "I think, therefore I am" by Descartes).

Finally, the lengthened average of interviews from the Knowledgeable group presented additional codes, and heightened support behind those codes by a higher frequency of mentions. Returning to the research behind metacognition and biofeedback, science currently accepts that witnessing feedback regarding one's performance can assist in the advancement of an individual aiming to change a sensation or ability. While both groups expressed a belief in adults' abilities to recover and change, the record of longer talk times combined with the supposition that will plays a major factor in ability indicates a difference between the groups. This supports the justification for quantitative research on how knowledge of neuroplasticity may influence perceived self-efficacy in recovery from addiction, anxiety, or depression.

Discussion

As presented, a difference in themes was demonstrated regarding the perception of self-efficacy from mental health recovery between groups of adults who have knowledge of neuroplasticity and those who don't. Themes related to internal factors (such as will) were more present in the Knowledgeable group and themes related to external factors (such as environment) were more present in the Non-knowledgeable group. Locus of control, which is the term describing an expectation of one's influence on an outcome being more internal or external, was not examined as a factor in this study during the research process (Nieben et al., 2022). However, based on the themes presented between the groups, it may be relevant to examine perceived locus control in participants in addition to perceived self-efficacy in future studies. Following the conclusion of this study, overarching questions to ask for psychology at large may be:

1. Should there be a focus on knowledge of neuroplasticity as an agent of change?
2. Is it possible that knowledge regarding brain malleability is innate?
3. Does knowledge of neuroplasticity affect one's locus of control?

Regarding the question of focusing on neuroplasticity as an agent of change, there is room for quantitative examinations regarding education of neuroplasticity as a self-regulation tool, particularly given the themes recorded in this initial qualitative study and the previous successful demonstration of biofeedback, CBT, and metacognition as regulation tools. As discussed in the introduction, evolution-

ary-based mental health disorders remain prevalent in the modern day, especially when set against a landscape of challenges in accessing clinical assistance. Through these questions, science can potentially develop additional quantitative studies which examine the components behind utilization of knowledge of neuroplasticity as an agent for recovery from mental health disorders, and not just as an agent for recovery from cognitive function due to brain damage.

Limitations

As this was a preliminary qualitative study, only 12 participants were interviewed total, with six in the Knowledgeable and six in the Non-knowledgeable group. As mentioned, during the thematic analysis, to accurately represent the importance of each code, the comments were quantitatively ranked by not only marking the codes mentioned, but also by counting the total number of mentions. However, the number of participants and the methodology doesn't qualify for statistical relevance, and so for this hypothesis to be validated in a statistical format, additional quantitative studies would need to be conducted. Considering the research as a qualitative study, whose purpose was to lay a groundwork for further research, no statistical analysis was completed due to a low-level of participants. Additionally, as this research was conducted as part of a student thesis, there was only one reviewer analyzing the codes, which may have left an individual bias in how the system was coded. Should another qualitative study be conducted to further examine this subject matter, it would be recommended to have additional researchers reviewing the codes and determining a final list of codes and themes in tandem. While no mention of neuroplasticity was made during the interviews themselves, since the survey sent out prior to the study as well as the information sheet included the term, it is possible that participants had done their own investigation and that had influenced their interviews.

Finally, the pool of participants ranged between three countries and a wide age range of adults, each of which may have their own cultural influences when it comes to their perception of recovery. It is possible that with a quantitative analysis we would see themes differ across demographics.

Practical Implications

The findings of this study suggest there may be a difference in how those with knowledge of brain malleability (Knowledgeable group) regard perceived self-efficacy when it comes to the recovery of mental health disorders versus those without knowledge of neuroplasticity (Non-knowledgeable group). As this study only utilized a small sample, it doesn't hold a statistical relevance, and so there are no immediate suggestions regarding practical changes in the administration of mental health care. Additional studies and analyses should measure the impact of these suggestions prior to practical applications being suggested for the adult population at large.

Suggestions for Further Research

Based on the study's findings from the Non-knowledgeable group, it was perceived that those without knowledge of neuroplasticity still held a belief that the brain can be re-coded through activity. While concepts regarding innate knowledge aren't popularized in modern-day psychology, it may be worthwhile to investigate where this seemingly "innate" understanding regarding malleability comes from - whether it is subliminal societal cues or education regarding brain plasticity occurring in subliminal formats. From this, we may understand better if this belief is indeed generally understood or if it is induced through learning. It would also be worthwhile to conduct such interviews across various cultures, as it is possible the answer would differ depending on different groups.

Furthermore, as indicated in the background section of this study, visualization (which as far as we understand isa faculty particular to humans) is a useful tool when it comes to re-arrangement of cognitive thoughts. Depending on the findings from any further studies on this topic, it may be beneficial to conduct an experiment of visualizing the re-routing of neural pathways as a mechanism for changing behavior.

Additionally, it is possible that individuals have received non-explicit affirmative feedback regarding brain malleability through experience. This may have been achieved through introspection following the changing of behavior over time or through the reward of society followingdemonstrated improvement (such as loved ones supporting an individual going through therapy). A further examination on how the topic of brain malleability may be subliminally shared in the west will help science understand the implications of this study. Finally, studies may ask in what ways can we quantitatively test the impact knowledge of neuroplasticity has on self-efficacy regarding recovery from mental health disorders.

Conclusion

Due to the perceived success of recovery and/or management of addiction, anxiety, or depression through CBT, biofeedback, and metacognition, this study's aim was to examine if adults with knowledge of their biological makeup may have a stronger perception in their ability to self-regulate their recovery from the above-mentioned mental health afflictions which may be evolutionarily induced. As presented, the findings between the Non-knowledgeable and Knowledgeable groups have recorded a variation in themes regarding sense of self-efficacy when it comes to recovery from mental health disorders of addiction, anxiety, and depression. These differences included:

- The Knowledgeable group's themes holding a focus on internal control, and the Non-knowledgeable group's themes holding a focus on external control.
- A higher sense that individual will plays a key role in the ability to change from the Knowledgeable group.
- A higher sense that privilege and access to basic needs is a major contribution to the ability to change from the Non-knowledgeable group.
- More lengthy interviews and ability to discuss the possibility to change from the Knowledgeable group

As this study had a small sample across three countries, we cannot yet state that there is statistical power regarding a heightened sense of perceived self-efficacy being associated with knowledge of neuroplasticity. However, the differences recorded in this study lay the foundation for further analyses which can explore a link between knowledge regarding brain malleability and the ability to self-regulate mental health disorders, as the Knowledgeable group generated codes relating to will and self-determination more frequently than the Non-knowledgeable group, and were able to discuss recovery at greater length.

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Table 1

Overall Superordinate and Subordinate Themes

Superordinate Theme	**Subordinate Themes**
The day-to-day environment is a key contributing factor in one's ability to change	• Community, family, friends and having a person is a key component to recovery
Possible techniques one can utilize range from medical to holistic	• Therapy • Writing / journaling
One's ability to change their behaviors or recover from addiction, anxiety or depression is not only possible, but promising	**N/A

Table 2

Superordinate and Subordinate Themes for Non-knowledgeable Group

Superordinate Theme	**Frequency** (1 mention per X min)	**Subordinate Themes**	**Codes**
Changing one's behavior is possible through activity	1:03 min	• Introduce randomness • Repetition as a driver for change	• Behavior (4) • Randomness (4) • Thoughts / cognitive (3) • Change the way you operate / view things / your brain works (3) • Training (2) • Adapting (2) • Remind myself (2) • Flexibility (2) • Habits (2) • Different situations • Regular basis • Developmental • Addictions they've created • Schedule • Day-by-day • New circumstances • Engineering of the mind • Kind of stunted • Reset the patterns • New synapses • Improve that part of your brain • Situations or perspectives • Smaller goals • Short term • Routing and discipline • Everyday practice • Constant practice & control
The day-to-day environment is a key contributing factor in one's ability to change	1:10 min	• Varied surroundings • Community/ Friends/	• Support (7) • Financial (5) • Observations (5) • Other people / have somebody (3)

		Family • Privilege	• Family / chosen family (2) • Time • Privilege • Positive reinforcement • Grew up in • Exposed • Segregated villages • What wealth meant • Having a garage • No significance of a car • Becomes the truth • Stumble upon • Doesn't know what a good gene is • Absent of knowing • Experience • Encourage • Reinforcement
The possible techniques one can utilize range from medical to holistic	1:43 min	• Writing	• Therapy/ counseling (6) • Writing (6) • Medication (3) • Resources (2) • Professional (2) • Meditation (2) • Poster child for Citalopram • Practical advice • You need to do this • Coaching • Very directed
Overall, one's ability to change their behaviors or recover from addiction, anxiety or depression is not only possible, but promising	1:55 min		• Change (7) • Yes (5) • Potential (3) • Can't apply to everything (2) • 50% • Possible • I think it's nonsense • Grain of salt • Mentality • Likely

Table 3

Superordinate and Subordinate Themes for Knowledgeable Group

Superordinate Themes	**Frequency** (1 mention per X min)	**Subordinate Themes**	**Codes**
Will is a key factor in changing behavior	0:50 min	• Positive mindset • Although possible, change isn't easy and takes effort • Openness	• Openness / receptiveness (4) • Hard / difficult (3) • If the will is there (3) • Positive mindset (2) • Hope (2) • Desire (2) • Coping mechanism (2) • Always a solution for everything (2) • Want (2) • Learned a lot (2) • Just tell myself / make myself (2) • Reward (2) • Effort (2) • Stuck in their ways • Getting ourselves out of that mode • Trying • Everyday will bring something new • 70% • Interested • It's up to you • Motivated • Individuals • People don't like to do it • A lot of work • Pattern • Falling really down • Find myself • If the dog is open to learning

			new tricks • I do think it comes down to that • Making his situation work • Difficult thing to change • All of the support and resources • Receiving that support • Don't believe change will happen • Conceivably capable • Not a curious person • Innate • Who manage • Motivation • Devoted • You can't have it • Don't want to do it • Eager • Accept • Ready • Research
The possible techniques one can utilize range from medical to holistic	1:09 min	• Therapy • Self-awareness • Writing / journaling	• Therapy (17) • Information / Awareness (8) • Medication (3) • Professional (3) • Writing / bullet journaling (3) • Removing temptation (2) • Find the right way (2) • Spirituality / religion (2) • Being uncomfortable • Not able to come out of it • Consider own circumstances • Meaning • Not necessarily • Routine
Overall, one's ability to change their behaviors or	1:20 min		• Yes /absolutely (9) • Possible (5) • 100% (5) • Don't believe that (5)

recover from addiction, anxiety or depression is not only possible, but promising			• They can (2) • Bad attitude • Not all of it • You can learn to do anything • Certainly something we can do • It will take a long time • Can be • A lot • That's true • Able • 5 • This idea • Incredibly hard • Potential
The day-to-day environment is a key contributing factor in one's ability to change	1:33 min	• Having a person / partner / friend or family	• Other people / have somebody (8) • Friends (5) • Resources (3) • Family / chosen family (3) • Housing (2) • Reinforcement (2) • Impact (2) • Partner (2) • Needs • Check in with each other • Quite lonely • Social beings • One person to rely on • Talk you through • That's real therapy • Accountability • Impact on them • Keep alert • Continue to learn • Innate • All really important (government resources) • Listen to us • Become curious