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Educational, clinical and counselling psychologists' perceptions of and readiness to incorporate brain technologies into their everyday practices.

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Chapter One: Introduction

1.1 Background and Context

Since the beginning of time, people have been mystified regarding how behaviour is produced. Attempts to gain an understanding of human behaviour are preserved in historical records of many different cultures (Kolb & Whishaw, 2003). According to the Dictionary of Psychology, it is not possible to simply define 'psychology'. It is postulated that Psychology is the creation of scientists and philosophers of various disciplines. It addresses the need to understand the minds and behaviours of others (Reber & Reber, 2001). "Simply to say that psychology is concerned with human behaviour does not distinguish it from other disciplines" (Stanovich, 2007, p. 6). Many disciplines that are concerned with human behaviour exist. Psychology is differentiated from other disciplines and is justified as an independent discipline for two reasons (Stanovich, 2007). Firstly, it studies the full range of human and nonhuman behaviour using scientific techniques. Secondly, the practical applications that have been derived are scientifically based, thus, the defining feature of psychology is that it is the data-based scientific study of behaviour (Stanovich, 2007).

During the early 1800's methods were developed to describe human behaviour quantitatively by examining and measuring the brain. For example, through the use of a device made of a wire and coil, it was discovered that the brain generated electricity (Robbins, 2000). It makes sense that since psychology is a science, and because technology is a significant part of our lives, attempts to incorporate scientific methods to study and explain human behaviour should be made (Kolb & Wishaw, 2003). Neuropsychology is the science of psychology (Kolb & Wishaw, 2003). It is this science that helps to curb some of the hostility directed towards psychology as a discipline, as some see the discipline as lacking a scientific base (Stanovich, 2007).

Over the past few years there has been a growing interest among psychologists, across the board (including Educational, Clinical and Counselling psychologists), regarding the

incorporation of technologies, such as EEG Neurofeedback and Quantitative Electroencephalograms (qEEG's), into their practices in order to facilitate therapeutic interventions (La Vaque, 1999; Robbins, 2000). Neurofeedback is an emerging neuroscience-based clinical application whereby an individual is able to learn how to modify the electrical activities of his or her brain through the process of operant conditioning (Becerraet al., 2006; Gunkelman & Johnstone, 2005). qEEG refers to an assessment tool whereby 19 sites on the scalp are mapped. This provides information on the frequencies in the brain which may be too high or too low in amplitude. With this information, the client is then taught to adjust their brain waves accordingly through the process of Neurofeedback training (Robbins, 2000).

Technologies such as these are advancing psychologist's understandings of the brain and human behaviour (Lezak, Howieson & Loring, 2004). The study of the brain is no longer confined to the brains of cadavers, nor does it necessarily require surgical interventions (Kolb & Wishaw, 2003). Due to modern technologies, we are now able to scan and assess a live functioning brain without such surgical interventions. For example, during functional Magnetic Resonance Imaging (fMRI), "changes in elements such as iron or oxygen can be measured while a person is performing a specific task" (Kolb & Wishaw, 2003, p. 168), indicating which part of the brain is activated during particular tasks or activities. Although psychologists may not directly use fMRI's in their practices due to the costs involved, information provided by this technology is still useful to psychologists. On the other hand, EEG Neurofeedback instruments can be used by psychologists in their practices as the equipment is relatively inexpensive when compared to that of the fMRI. Furthermore, the equipment is compact and thus can be accommodated in private practices (Demos, 2005; Hammond, 2006; Hughes & John, 1999). Brain technologies, such as EEG Neurofeedback, allow psychologists to incorporate scientific measures into their practices (Demos, 2005). qEEG's are valuable in assisting the psychologist by identifying specific problem areas in the brain (Hammond, 2006; Robbins, 2000).

1.2 Rationale

Validation studies have shown that EEG Neurofeedback and qEEG's are being successfully used to treat a number of disorders. Boll (1977, as cited in Shenal, Rhodes, Moore, Higgins & Harrison, 2001) posed that "by establishing a connection between neurological criteria and human behaviour, the base for developing an understanding of brain-behaviour relationships is provided" (p. 34). With advances in brain technologies, such relationships can be established and quantified, which in turn has positive implications for therapy.

Demos (2005) asserts that "Neurofeedback is technology's answer to psychotherapy, cognitive rehabilitation and poor cerebral functioning" (p. 3). Moreover, he also maintains that it has been successfully used in the treatment of many clinical disorders. These will be discussed in more depth in the literature review and include: depression (Baehr, Rosenfeld & Baehr, 1997, 2001; Davidson, 1998; Hammond, 2005a; Hughes & John, 1999; Walker, Lawson & Kozlowski, 2006); anxiety (Egner & Gruzelier, 2003; Passini, Watson, Dehnel, Herder & Watkins, 1977; Walker, 2009); posttraumatic stress disorder (PTSD) (Agnithorti, Paul, & Sandhu, 2007; Walker, 2009) as well as alcoholism and substance abuse (Bauer, 1993, 2001; Burkett, 2005; Burkett, Cummins, Dickson, & Skolnick, 2005; Hammond, 2006; Saxby & Penniston, 1995; Sokhadze, Cannon & Trudeau, 2008; Trudeau, 2005; Winterer et al., 1998). Furthermore, it has also been an effective treatment for disorders of early childhood, such as attention-deficit/hyperactivity disorder (ADHD) (Beauregard & Lévesque, 2006; Fox, Tharp & Fox, 2005; Linden, Habib & Radojevic, 1996; Lévesque, Beauregard & Mensour, 2006; Monastra, Lynn, Linden, Lubar, Gruzelier & LaVaque, 2005; Monastra, Monastra & George, 2002), autistic spectrum disorder (ASD) (Coben & Padolsky, 2007; Jarusiewicz, 2002; Kouijzer, Moor, Gerrits, Buitelaar & van Schie, 2009; Scolnick, 2005; Sichel, Fehmi & Goldstein, 1995) learning disorders (Becerra et al., 2006; Chabot, Michele, Prichep, & John, 2001; Egner & Gruzelier, 2004; Fernandez et al., 2007) and obsessive-compulsive disorder (OCD) (Association for Applied Psychophysiology and Clinical Neuroscience Society [AAPB], 2004, 2008; Hammond et al., 2004; Hammond, 2005a, 2006). Neurotherapy has also been successful in transforming the lives of people with seizure

disorder and epilepsy (AAPB, 2004; AAPB, 2008; Kotchoubey et al., 1996; Kotchoubey, Blankenhorn, Forscher, Strehl & Birbaumer, 1997; Kotchoubey et al., 2001; Sterman & Egner, 2006; Swingle; 1998). Furthermore, Neurotherapy has been found to be effective in symptom reduction in victims of closed-head injuries and headaches as well as cognitive enhancement in those with age-related cognitive decline (AAPB, 2008; Angelakis et al., 2007; Hammond, 2006; Schoenberger, Shiflett, Esty, Ochs & Matheis, 2001; Thornton, 2000).

These technologies are also beneficial as they allow for the documentation of abnormal electrophysiological activity (La Vaque, 1999). In the case of the qEEG, the documentation provided allows the therapist to see exactly where the problem areas, that need to be addressed, are in the brain. Therefore, with these technologies early detection and treatment of problems is made possible (Evans, 1998; Hammond, 2006). Furthermore, the cost of treatment is minimized as these methods are target-specific and the client need not be engaged in long term therapy if the particular problem can be identified at the onset of therapy and rectified (Hammond, 2006).

Despite the advantages of these technologies, a tendency still exists to oppose the expansion of science into areas where unquestioned authorities have long reigned (Stanovich, 2007). The intent of this study is to gain an understanding of the perceptions as well as the resistance that professionals in psychology may have towards these technologies. In doing this, it will be possible to begin to address these issues. A fair amount of research has been and continues to be conducted on the possible benefits of these technologies (Hammond, 2006). However, research on the perceptions of psychologists towards these technologies is scarce. Resistance to scientific psychology is real and due regard needs to be given to these perceptions held by those in the field of psychology so that this resistance can be addressed (Stanovich, 2007). For this reason, this study aims to address this issue by adding to this knowledge base.

1.3 Aims

This study aims to investigate the perceptions of psychologists regarding incorporating new technologies, such as EEG Neurofeedback and qEEG's, into their everyday practices. This research further aims to consider possible resistance professionals may have towards these new technologies. Finally, this study intends to look into suggestions made by the participants regarding what they feel would make the incorporation of these technologies into their practices easier.

1.4 Summary of Chapters

Chapter one affords a brief introduction to the study.

Chapter two provides a general overview of the history of EEG Neurofeedback and qEEG, as well as looking at perceptions and attitudes and how this affects behaviour and resistance. Additionally, an overview of the research in the field of Neurotherapy and qEEG is provided.

Chapter three states the research questions and describes the research sample, measure and procedure of the study.

Chapter four discusses the results of the study.

Chapter five presents a discussion of the research findings. The shortcomings of the research are discussed and recommendations for future research are made.

Chapter Two: Literature Review

2.1 Neurotherapy and qEEG

2.1.1 History of EEG Neurofeedback and qEEG

"The history of biofeedback (including Neurotherapy) is built upon the cornerstones of technology, electronics, behaviourism, physiology and neurology" (Demos, 2005, p. 15).

"Biofeedback is a process that enables an individual to learn how to monitor and change physiological activity for the purposes of improving health and performance" (International Society for Neurofeedback and Research [ISNR], 2009). It is a technique to achieve voluntary control of physiological functions, such as heartbeat, breathing and blood pressure) which are normally regulated involuntarily (EEG Spectrum International, 2008).

Biofeedback's first key historic event is considered by many as the scientific research of an English physician, Richard Caton, who was the first to discover that the brain generated electricity (Robbins, 2000). He then made the discovery in 1875 that fluctuations in the brain's electrical activity followed mental activity (Demos, 2005). Caton's experiments entailed the placement of electrodes in the open or exposed brains of animals (Demos, 2005; Masterpasqua & Healey, 2003). He found that he could detect a weak flow of current across an unopened skull. This was the keystone to what would become the "brains electrical signature, the electrical encephalogram" (Robbins, 2000, p. 16).

In 1920, Hans Berger expanded on Caton's work and measured the electroencephalograph (EEG) on the human scalp and subsequently became the first to record raw EEG on paper (electroencephalogram). The EEG has proven to be "a valuable tool for studying sleep, monitoring the depth of anaesthesia, diagnosing epilepsy and brain damage as well as studying normal brain function" (Kolb & Wishaw, 2003, p. 150). Berger's landmark paper was published in 1929. He posited that abnormalities in EEG readings reflected clinical disorders (Demos, 2005). In 1934, two British psychologists, Adrian and Matthews, replicated Berger's

measurement of these "electrical waves" (Robbins, 2000, p.20).Yet, scientists continued to question the idea of voluntary control of the autonomic nervous system. They believed that biological processes such as heart rate variability, blood pressure and hand temperature were controlled by the body (Demos, 2005). Miller (1960, as cited in Demos 2005; Robbins, 2000) secured the foundation of Biofeedback when he proved that subjects could indeed alter their Autonomic Nervous System (ANS) functioning via operant conditioning.

Neurofeedback originated in the 1960's when two different researchers, located in different areas of the U.S.A and seemingly doing work in unrelated areas, began to explore phenomena associated with brainwave activity (Bissette, n.d/2009; Demos, 2005; Robbins, 2000). Kamiya (1963, as cited in Bissette, n.d/2009; Demos, 2005; Robbins, 2000) investigated consciousness by eliciting alpha wave activity in the brain. In doing so, he discovered that a number of people were able to learn to identify when their brains were producing alpha waves. Alpha waves characterize a type of brain wave emitted by the brain when one is in a calm state. Subsequently, these individuals also learned how to increase their production of the alpha brain wave, which had a relaxing effect. By using a simple reward system, Kamiya conducted the first EEG Biofeedback training (Bissette, n.d./2009; Demos, 2005; Robbins, 2000).

Sterman (1996), a sleep researcher, utilised an EEG instrument in his endeavour to establish whether sleep was a conscious choice or an automatic process. He replicated research regarding operant conditioning by Pavlov, however his research differed in two significant ways; he utilised cats instead of dogs and his EEG equipment allowed him to record the responses of the brain. Initially, the cats were conditioned to push a lever to receive food (Robbins, 2000; Sterman, 1996). Thereafter, the cats were conditioned to wait for the sounding of a tone to stop before they could push the lever again. Sterman believed that this inhibition would result in a form of microsleep, seeing as the cats sat motionless throughout the duration of the tone. However, the EEG equipment revealed a new EEG rhythm that had not been seen before, which Sterman referred to as a Sensorimotor Rhythm (SMR) (Robins, 2000; Sterman, 1996). Sterman, thus discovered that he could train cats in his laboratory to alter their EEG activity through utilising operant conditioning (Sterman, 1996).

Sterman's research resulted in another coincidence when he investigated whether rocket fuel could cause seizure activity and so exposed the cats to a volatile fuel called Hydrazine. Half the cats experienced seizures while the other half (those that had increased SMR- brainwaves) had a dramatic reduction in seizures, which was an unexpected outcome (Robins, 2000; Sterman 1996). After doing additional research, it was decided to use EEG Neurofeedback training with humans who suffered from epilepsy. This training along the sensory motor strip of the brain had the same inhibitory effect that it had on the cats and the subject's seizures were controlled (Robbins, 2000; Sterman, 1996). In fact, Sterman (1968, as cited in Bissette, n.d./2009) later discovered that the seizure levels of those he worked with were reduced by 20-100% in 60% of the cases, and that these results tended to be long lasting.

The introduction of computers and machinery lead to the emergence of the field of quantitative electroencephalography (qEEG). Computers made it possible to digitise signals recorded from the scalp, identify specific electrical wave patterns within each signal, display these patterns on a computer screen and store the digital data within microseconds (Kaiser, 2007). In the 1970's and 1980's, qEEG assessments with normative databases grew to be a reality. This meant that it was possible to compare the brainwaves of each individual to a sample normative population. A 19-channel system for qEEG data collection was developed and in doing so provided the clinician with a topographical brain map to assess brain functioning (Demos, 2005). The development of relatively inexpensive desktop computers in the 1990's placed qEEG technology in the hands of clinicians (Kaiser, 2007).

2.1.2 What is Neurofeedback?

Neurofeedback training is "brainwave biofeedback" (Hammond, 2006). It provides information from a live EEG of an individual's psychological functioning. A distinguishing factor of the Neurofeedback training is the focus on the central nervous system and brain. The process allows for an objective assessment of brain activity and psychological status. Brainwaves occur at various frequencies and are measured in cycles per second or hertz (Hz) (Hammond, 2006). The higher the hertz, the faster the brain wave. It is posited that the human brain generally operates

within a range of from 1 to about 40 hertz (Robbins, 2000).The EEG frequency range has been divided into six (6) categories: *delta*: 0.5-4 Hz*; theta*: 4-8 Hz; *alpha*: 8-13 Hz; *sensorimotor (SMR)*: 12-15 Hz; *beta*: 1535 Hz; *gamma*: 35-50 Hz (Hammond, 2006). Figure 2.1 depicts the various types of brain waves.

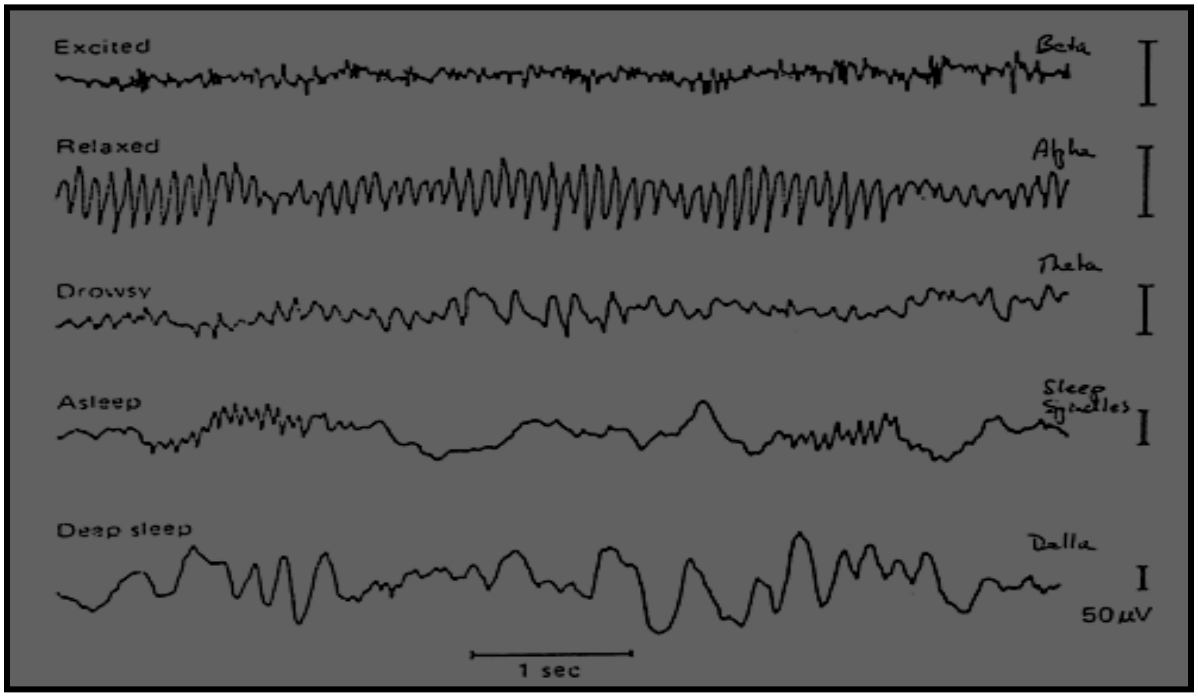

Figure 2.1 EEG recordings of the various brainwaves

Note. Retrieved from http://www.neurodevelopmentcentre.com *Accessed November, 1, 2009.*

As can be seen from Figure 2.1 above, delta and theta are known as slow wave activity and are associated with states such as daydreaming and drowsiness. Alpha brainwaves are slower and larger and are associated with a relaxed state of unfocused attention. Beta brainwaves are small, faster brainwaves associated with a high alertness, concentration and focused attention (Linden et al., 1996). It is these brainwaves that are conditioned in the process of Neurofeedback training. Different levels of awareness are generally associated with dominant brainwave states (Hammond, 2006). High frequency delta brainwaves are often associated with learning disabilities. When a person is exceptionally anxious and tense, an excessively high frequency of beta brainwaves is often present (Hammond, 2006). Attention Deficit/Hyperactivity Disorder

(ADD/ ADHD), head injuries, stroke, chronic fatigue syndrome and fibromyalgia tend to be characterized by the presence of excessive slow waves, usually theta but sometimes excess alpha. Persons with an excessive amount of slow waves present in the executive (frontal) parts of the brain will find it difficult to control attention, behaviour and/or emotions (Hammond, 2006). Neurofeedback training begins with a qEEG (Quantitative Electroencephalogram) assessment, as will be described further on in the literature review, which then guides the Neurofeedback training process by individualizing the training to the distinctive brainwave patterns and symptoms of each client (Hammond, 2005a).

During training, electrodes are placed on the client's head to record brainwave activity as can be seen in Figure 2.2. Two electrodes are placed on the scalp at the locations where EEG activity is considered problematic. Reference and ground electrodes are placed on the earlobes (Hammond, 2005a). The Neurofeedback instrument is programmed by the therapist to address the specific area in which the client is experiencing difficulty. There are two computer screens. On the therapist's screen a live EEG is displayed while the client learns to voluntary control their brainwaves by engaging with a computer game on the other screen. The goal of "brainwave training" is for the client to learn how to voluntarily enhance or decrease their brain activity using a form of operant conditioning that is shaped by an auditory and visual feedback system, provided by the instrument (EEG Spectrum International, 2008).

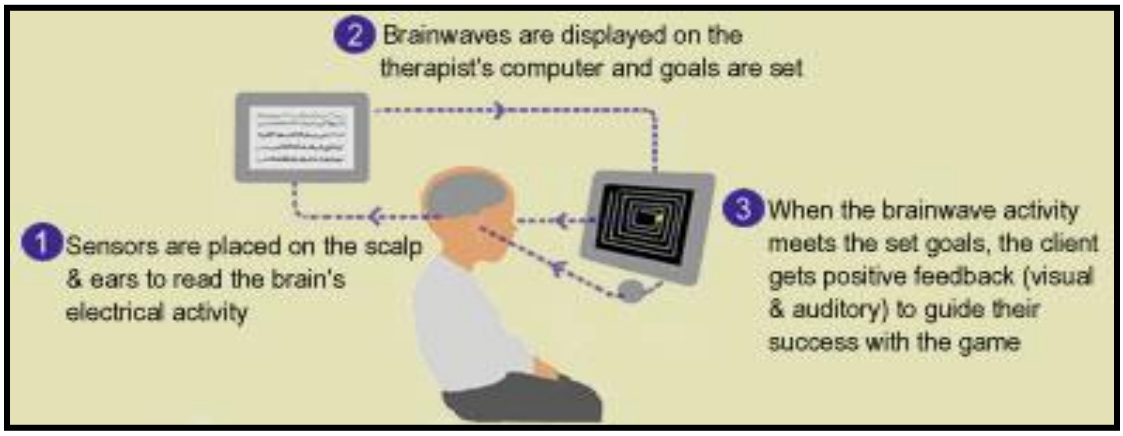

Figure 2.2 The Neurofeedback training session

Note: Giannakali, 2007. Retrieved from http://bipolarblast.wordpress.com. Accessed on November, 1, 2009.

Neurofeedback is based on Operant conditioning, "which is an associate form of learning in which behaviours are regarded as associations between events, and responses are strengthened through positive reinforcers (rewards) or negative reinforcers (punishments)" (Eloff & Ebersohn, 2004, p. 16). Thorndike formulated two interrelated learning laws on which operant conditioning is based, namely: the law of practice and the law of effect. According to the law of practice, "learning and retaining a response depends on how frequently and how recently the response has been associated with a particular stimulus situation" (Jordaan & Jordaan, 2000, p. 453). According to the law of effect, "learning and retaining a response depends on the effect of executing that response" (Jordaan & Jordaan, 2000, p. 453).

Accordingly, during EEG Neurofeedback training the client is rewarded with auditory and visual feedback when they are producing the desired brainwaves. For example, the computer registers the changes in the brainwaves and either an image (such as a spaceship or packman) will move accordingly or a pleasant tone may be emitted. This depends on the programme utilised (EEG Spectrum International, 2008; Gunkelman & Johnstone, 2005; Hammond, 2006; Thomas, n.d./2009). EEG Neurofeedback enables a person to become aware of their brainwave patterns and in turn become capable of reliably influencing and changing their brainwave activity. The brain is thus reconditioned and retrained into more normal patterns through this process of operant conditioning (Gunkelman & Johnstone, 2005; Hammond, 2006; Kaiser, 2005; Masterpasqua & Healey, 2003; Thomas, n.d./2009).

The Neurofeedback EEG is used as a measure of the brain's control of emotions, cognitions, motor behaviour and other aspects of brain functioning (EEG Spectrum International, 2008). The effects of Neurofeedback on the brain are believed to be reflected in: the frequency and timing of the EEG; stability and arousal; blood flow and metabolism; neurochemical levels; and the density and connectivity of neurons (EEG Spectrum International, 2008). There are various advantages of Neurofeedback training. Firstly, the client becomes an active participant in change. Secondly, feelings of self-efficacy are enhanced as the client learns self-control over symptoms. Neurofeedback training offers a new alternative or adjunct to medication and other therapies (Gunkelman & Johnstone, 2005; Hammond, 2006; Oubr, 2002; Thomas, n.d./2009).

Furthermore, undesirable effects as with medication side-effects are uncommon with Neurofeedback (EEG Spectrum International, 2008; Gunkelman & Johnstone, 2005; Hammond, 2006). In addition, Neurofeedback is believed to produce longer lasting effects then most medications used in ADHD (Monastra et al., 2002; Alhambra, Fowler & Alhambra, 1995).

2.1.3 What is a Quantitative Electroencephalogram?

Quantitative Electroencephalography (qEEG) is an assessment of electrical patterns at the surface of the scalp which primarily reflect cerebral cortical activity or "brainwaves" through the use of digital technology (Hammond, 2006; Thomas, n.d./2009; Walker et al., 2006). A cap that contains 19 small electrodes to measure brain electrical activity is placed on the head. It can be done whilst the client is resting quietly with their eyes open, closed, or even whilst the client is engaged in a task, such as reading (Hammond, 2006; Thomas, n.d./2009). Brain wave activity is recorded and converted into numbers by a computer. These numbers are then statistically analysed and converted into a colour map of brain functioning (see Figure 2.3). Subsequently, the therapist is able to identify areas in the brain that are overactive, underactive or not working optimally. This brainwave data is compared to a large normative data base (Hammond, 2006; Thomas, n.d./2009). This information is then used to help assess the kind of brain training that holds the most promise. Neurofeedback training can then be used to teach the client how to adjust those site-specific brainwaves through the process of operant conditioning (Collura, 2009; Kaiser, 2005; Robbins, 2000). Pre and post testing provides an objective measure of the problem (Robbins, 2000). Figure 2.3 below offers a graphic representation of the brainwaves which are converted into a colour map.

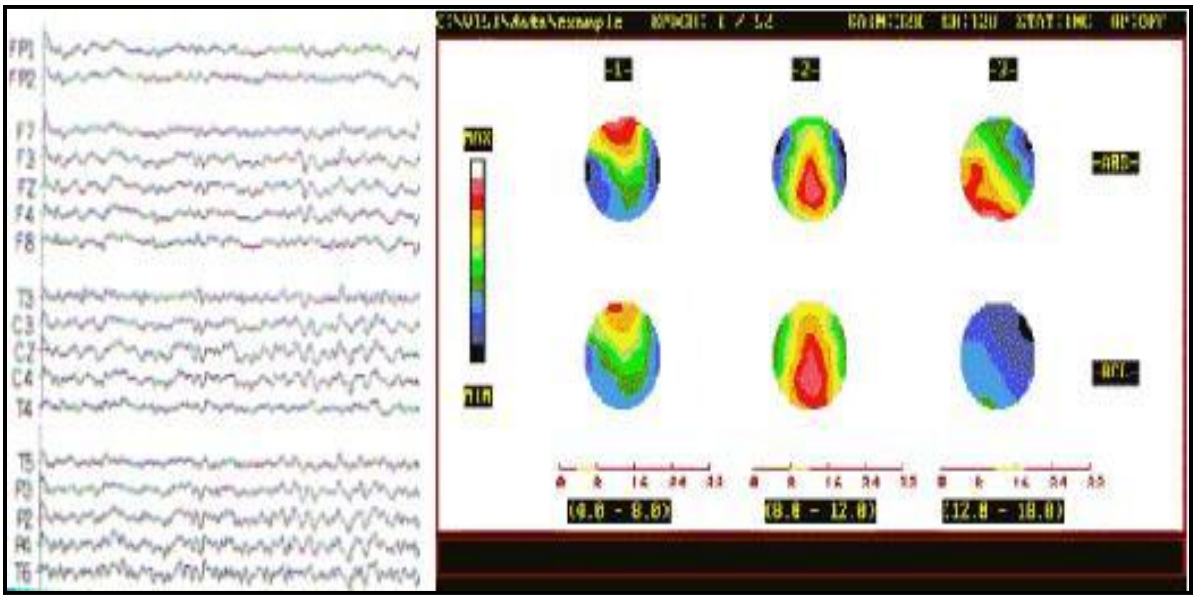

Figure 2.3 Measurements from the 19 sites are converted into a colour map showing abnormalities in brain waves

Note: Retrieved from http://www.drmuellerhealthpsychology.com/Treatments_QEEGAssessment.html&usg. Accessed November, 1, 2009.

> Assessment of EEG activity is typically presented as coherence, symmetry and spectral power. Coherence is a measure of synchronization between activity in multiple channels. Symmetry analyses present the data as a ratio of power in each band between a symmetrical pair of electrodes. The spectral power measure combines amplitude with frequency to indicate the overall energy of a waveform within a particular frequency band (Shenal, et al., 2001, p. 36).

qEEG's have been shown to aid in the evaluation of conditions such as mild traumatic brain injury (Hoffman et al., 1999; Thatcher et al., 1999; Walker, 2009), attention deficit disorder/attention deficit hyperactivity disorder (Walker, 2009), learning disabilities (Walker, 2009), depression (Suffin et al., 2007), obsessive-compulsive disorder, anxiety and panic disorder (Hughes & John, 1999). Figure 2.4 illustrates how the qEEG can effectively identify specific problem areas in the brain.

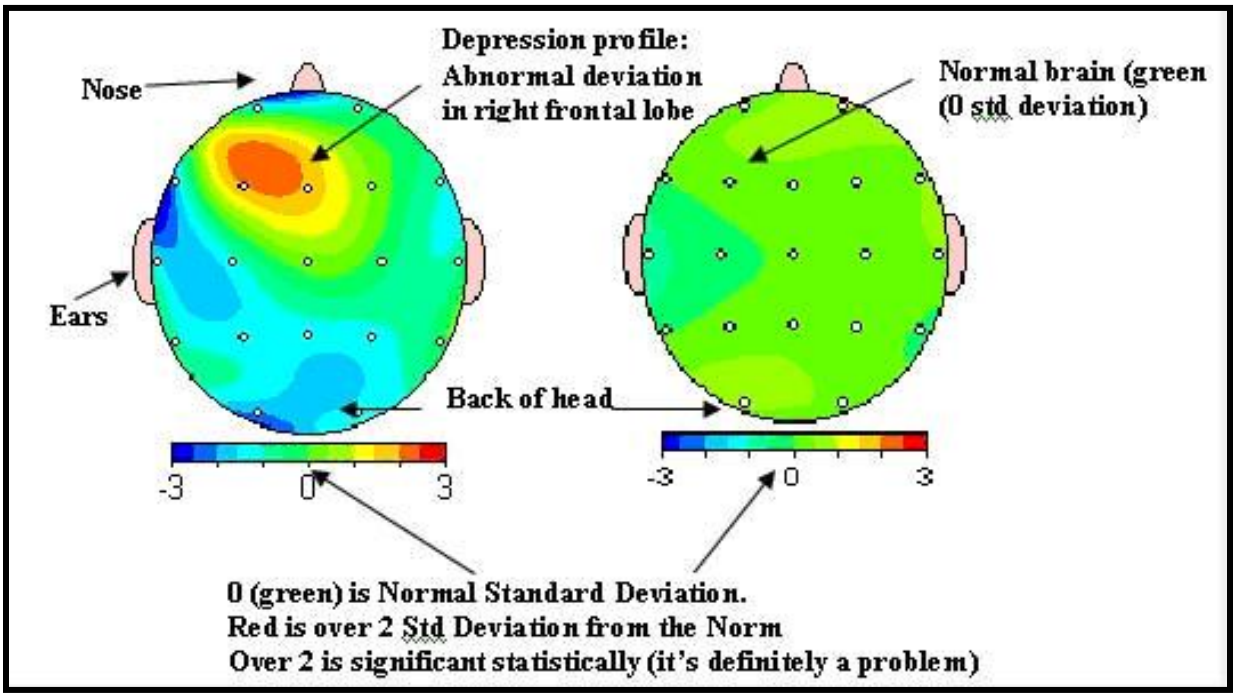

Figure 2.4 A qEEG depression profile showing abnormal deviation in the right frontal lobe

Note: Retrieved from http://www.centerforbrain.com/brainmapping.html&usg. Accessed on November, 1, 2009.

A further benefit of the qEEG is that if compared to fMRI it can map brain functioning in a relatively inexpensive way. Some qEEG studies show the promise of predicting the likelihood of an individual's response to a particular pharmacological treatment as well as providing a means through which the individual's responsiveness to treatment can be effectively monitored and evaluated (Bauer, 1993, 2001; Winterer et al.,1998).This facilitates treatment by minimizing false starts, decreasing severity and shortening the duration of symptoms as well as reducing costs (Hughes & John, 1999). Furthermore it is stated by Hughes & John (1999), that through the use of these brain imaging technologies, it has been established that a definite correlation exists between mental illness and brain dysfunction.

2.1.4 qEEG, Neurofeedback and Evidence-Based Practice

"Evidence- based practice is a process of using the best evidence, preferably research findings, to guide delivery of health services" (AAPB, 2008, p. iv). In Evidence-Based Practice two things

need to be taken into account, namely Efficacy and Effectiveness. "Efficacy refers to the determination of a training or treatment effect derived from a systematic evaluation obtained in a controlled clinical trial" (AAPB, 2008, p. iv; La Vaque, et al., 2002). "Effectiveness" is concerned with "how well a treatment works in actual clinical settings, with more typical clinical populations" (AAPB 2008, p. iv).

In terms of the use of qEEG in evidenced practice Hughes and John (1999, p. 12) point out that "Of all the imaging modalities, the greatest body of replicated evidence regarding pathophysiological concomitants of psychiatric and developmental disorders has been provided by EEG and qEEG studies". It is further illustrated that the EEG is also the most practical of these as it uses relatively simple, inexpensive and compact equipment which can be easily accommodated in clinics, hospitals and private practices. However, they note that despite the extensive evidence of the sensitivity and specificity of these brain technologies, the adoption of them has been slow. In their opinion, the following are responsible for this: Firstly, the majority of recent papers reporting results of EEG and qEEG studies have been published in specialised journals which mean that the majority of psychology professionals are not being exposed to this research and thus it remains largely unfamiliar to the general field of psychology. Secondly, they argue that professional organisations have created considerable controversy over the past decade concerning the clinical utility of these technologies as a result of papers they published which contained statements based on limited information. Moreover, Hughes & John (1999, p. 12) contend that "during the last decade, more than 500 EEG and qEEG papers have reported well-designed studies, concurring that EEG and qEEG abnormalities are found in a high proportion of psychiatric patients".

The AAPB (2004; 2008) asserts that Neurofeedback provides the evidence-based practice that is demanded by mental health care professionals. The AAPB further argues that EEG biofeedback has been applied, tested and proven in research as well as in practice. However, concerns have been raised regarding the scientific basis of research conducted thus far. In order for Neurofeedback to be considered scientifically efficacious controlled, randomised and double-bind studies are important (Evans, 1998; La Vaque, 1999; Masterpasqua & Healey, 2003; Oubr,

2002; Robins, 2000). Conducting such studies within this field is considered expensive and time consuming; as a consequence much of the research may be seen as only in its early stages (Evans, 1998; Hammond, 2006; Robins, 2000). The data regarding ADHD and Epilepsy has started to accumulate for the efficacy of Neurofeedback treatment. Furthermore, research related to the efficacy of Neurofeedback in other disorders is still experimental yet further research efforts are continued thereby building on the knowledge base of Neurofeedback (Hammond, 2006). Moreover, the ISNR and the AAPB are only two of many organisations across the world which promote and fund research within the field as well as encourage the use of ethical standards of practice in the use of these therapies (Angelakis et al., 2007; Gunkelman & Johnstone, 2005).

2.1.5 Standards of practice for professionals utilising qEEG and Neurofeedback in the treatment of various disorders.

One particular danger to the credibility of Neurofeedback as a reputable treatment of various disorders is the fact that almost anyone can purchase EEG equipment and perform Neurofeedback procedures. This may lead to ineffectual and possibly harmful use, thus it brings to light the need for qualifications in using the therapy in the treatment of disorders. It is thus posited that the application of Neurofeedback requires a professional who is knowledgeable and adept within this field. In addition, it further emphasises the need for the involvement of a regulatory body in the use of these technologies (Evans, 1998; Hammond et al., 2004, Hammond, 2006; Sterman & Egner, 2006).

The Board of Professional Affairs of the American Psychological Association, as well as other psychological associations in the United States of America (USA), consider the use of qEEG and Neurofeedback within the scope of practice of psychologists if they have received additional training in this field. It is not necessary for a neurologist to screen the EEG or qEEG data prior to the psychologists use thereof (Hammond et al., 2004, Masterpasqua & Healy, 2003). Moreover, certification with the Biofeedback Certification Institute of America (BCIA) is also a requirement in utilising qEEG and Neurofeedback technologies. Certification is only given to

professionals registered with their state's health boards and is achieved by completing a 36 hour course with a BCIA approved trainer, a three hour exam and a minimum of 25 hours of supervision with a BCIA approved supervisor. Additionally, recertification is required every four years in order to ensure that the practitioners are up to date with the most recent developments in the field (Angelakis et al., 2007). There are various organisations in the USA and internationally involved in the research and practice guidelines, namely the International Society for Neuronal Regulation (ISNR), Association for Applied Psychophysiology and Clinical Neuroscience Society (AAPB) and the Biofeedback Certification Institute of America (BCIA).

In South Africa the training regarding Neurofeedback is offered by Neuro-logics, which is affiliated with the reputable international training organisation EEG Spectrum (Neuro-logics, n.d./2009). The training offered by EEG spectrum is BCIA and APA approved and is thus regulated within the context of the USA (Hammond et al., 2004). However, there does not seem to be a body regulating the training in Neurofeedback specifically in South Africa.

2.1.6 Who benefits from Neurofeedback Training and qEEG?

Neurotherapy or Neurofeedback training has been used within many areas of therapy and in numerous settings. An overview of some of this research will follow below.

2.1.6.a Attention Deficit Hyperactivity Disorder (ADHD)

Attention Deficit Disorder with or without hyperactivity is one of the most common disorders diagnosed and treated by adult and child psychiatrists and commonly seen in the field of Educational Psychology (Linden et al., 1996). The efficacy of Neurofeedback training in the treatment of ADHD has been well documented.

A study by Linden et al. (1996) utilised a random design to compare two groups of individuals with ADHD. One group received 40 sessions of Neurofeedback training and the effects of the training were then compared to that of the control group which did not receive Neurotherapy training. The results of this study showed an improvement on a measure of intelligence

(Kaufman-Brief Intelligence Test) as well as a reduction in ADHD symptoms on a behaviour rating scale in the Neurofeedback group.

Subsequently, a one year treatment study by Monastra et al. (2002) found that Neurotherapy produced superior improvements to Ritalin. Furthermore the study revealed that even after the medication was discontinued the benefits of Neurotherapy remained. A hundred children aged 6-19 years underwent the treatment, which included Ritalin, parent counselling as well as support at school. Of these children, 51 participants also received Neurofeedback. Results indicated that it was only those who had received Neurofeedback that showed sustained gains when tested without Ritalin one year later (Monastra et al, 2002).

A recent study by Lévesque et al. (2006) used fMRI to document and identify the positive changes that occurred in brain function in children with ADHD after receiving Neurofeedback treatment. A sample of 20 children who had been diagnosed with ADHD were randomly assigned to either the experimental (consisting of 15 children) who received the Neurofeedback or the control group (consisting of five children) who did not receive any treatment. None of the participants were taking any psychostimulant medications at the time of the study. In addition, the children were not diagnosed with any comorbid disorders. Both groups were given two tasks to complete while being scanned with an fMRI one week prior (time 1) to and one week after (time 2) the Neurofeedback was provided to the experimental group. No significant differences were noted between the experimental and the control group at time one. However, there appeared to be significant improvements within the tasks as well as activations of areas of the brain associated with selective attention after the Neurofeedback had been provided to the experimental group. These results indicated that Neurofeedback training has the capacity to normalise functioning of the parts of the brain involved in selective attention in children with ADHD once again demonstrating the efficacy of using Neurofeedback in the treatment of ADHD.

A very similar study by Beauregard and Lévesque (2006) assessed the effects of Neurofeedback on areas in the brain associated with selective attention as well as response inhibition through

fMRI experiments. The sample size and the sample characteristics were similar to those in the previous study by Lévesque et al. (2006). As in the abovementioned study the Neurofeedback training showed the capacity to normalise functioning parts of the brain involved in selective attention as well as response inhibition in children diagnosed with ADHD.

2.1.6.b Learning Disorders (LD)

According to the APA (American Psychological Association, 2000), Learning Disorders (LD) are diagnosed when an individual's achievement on individually administered, standardized tests in reading, mathematics, or written expression is substantially below that expected for a particular age, schooling, and level of intelligence. Wide consensus indicates that an excess in delta or theta waves and deficiencies in alpha or beta waves are common in children with learning difficulties (Egner & Gruzelier, 2004). Neurofeedback has been shown to decrease the theta/ alpha ratio which has proven useful in treating children with learning disorders (Fernandez et al., 2003).

In a study conducted by Orlando and Rivera (2004) various pre- and post-test cognitive and reading assessments were administered to pupils with learning disorders. Those who received the EEG biofeedback training showed improved timing in reading as well as improved time on the verbal IQ and on the Full Scale IQ. Therefore, the study concluded that EEG biofeedback training is believed to be an effective tool in improving reading quotients and IQ's in children with learning disabilities. Nonetheless, it appears that further research in this area is needed.

Fernandez et al. (2003, as cited in Becerra et al., 2006) demonstrated the efficacy of Neurofeedback with a placebo-controlled study of children with learning disabilities (LD). The Neurofeedback treatment given to the experimental group resulted in EEG maturation which did not occur in the placebo group, which indicates that the changes were due to Neurofeedback and not only development. Consequently, Neurofeedback was concluded as an effective treatment for learning difficulties (Fernandez, et al., 2003 as cited in Becerra et al., 2006). Becerra et al. (2006) conducted a two year follow up study of the previous study with all of the same participants except for one to determine the long term effects of the Neurofeedback. The experimental group

was comprised of the same five children from the experimental group of the previous study whereas the control group consisted of four of the five children. The behavioural changes noted in the previous study continued throughout the two years in the experimental group. Moreover, four of the five children in the experimental group showed positive behavioural changes which resulted in a normal neurological diagnosis whereas the diagnosis of LD remained in the control group. It was thus concluded that there are beneficial effects in Neurofeedback for up to two years following the treatment. It is however, important to take note of positive extraneous factors such as other treatments that may have occurred during the two years (Becerra et al., 2006).

A further study by Fernandez et al. (2007, p. 167) was undertaken, the objective of which was to examine the "changes produced by Neurofeedback on the EEG current sources as well as on the behaviour of LD children with abnormal theta/alpha ratios in their EEG's". Even though 109 children between the ages of seven and eleven were referred for the study, only 16 met the inclusion criteria. The study involved an experimental group of 11 children who received Neurofeedback and the control group of five children who received a fake treatment. The study concluded that "EEG current source analysis is a valuable tool for understanding the neurophysiological bases of Neurofeedback" (Fernandez et al., p. 180). Furthermore, the researchers stated that "in LD children with an abnormal theta/alpha ration, improvement in this ratio normalizes EEG oscillations in cerebral regions that may, in turn, explain the positive behavioural changes produced by Neurofeedback" (Fernandez et al., p. 180).

A recent study by Breteler, Arns, Peters, Giepmans and Verhoeven (2009) utilising a randomised control design attempted to reduce reading and spelling difficulties experienced by dyslexic children through the use of qEEG based Neurofeedback. The sample consisted of nineteen children, 10 of which received 20 sessions of Neurofeedback training (experimental group) over a ten week period. The control group (n=9) and experimental group both received remedial teaching. Results showed a significant increase in spelling in the experimental group. There was however no improvement found in reading. It was further discovered that a significant increase of alpha coherence was present suggesting that attentional processes are involved in the improved spelling.

2.1.6.c Autistic Spectrum Disorders (ASD)

Autism is classified as a pervasive neurodevelopment disorder characterised by qualitative impairment in social interaction, disturbances of communication and language, stereotyped and restricted repetitive behaviour, as well as an instability in moods (Coben & Padolsky, 2007; Sadock & Sadock, 2007). A case study of an eight-year old boy with mild autism reported that he showed improvement after 31 sessions of Neurofeedback training (Sichel et al., 1995). The behavioural and brain wave changes in this child were attributed by the researchers to the Neurofeedback training and suggestive of Neurotherapy as possibly being an effective treatment for some of the symptoms of mild autism (Sichel et al., 1995).

Further evidence was provided by a study by Jarusiewicz (2002). In the study 24 autistic children were divided into two groups (control and experimental). Both groups were similar in age, sex and disorder severity. Only the individuals in the experimental group received a minimum of 20 sessions of Neurofeedback training. The experimental group exhibited significant improvements (up to a 26% reduction) in their autistic symptoms and behaviours which included socialisation, vocalisation, schoolwork, tantrums and sleep.

In a research study by Scolnick (2005) five children diagnosed with Aspergers syndrome received 24 sessions of Neurofeedback. After the treatment parents and teachers reported improvements in the children's behaviour in terms of less anxiety, more flexibility, higher self-esteem, more empathy, improvements in frustration tolerance, increased social interaction and fewer severe mood changes. However, the process of maturation could not be ruled out as a reason for the improvements and thus further research is needed.

Extending on the work of Jarusiewicz (2002), Coben and Padolsky (2007) carried out a controlled study using multiple measures of behavioural, neuropsychological and neurophysiological functioning. In this study, 37 children with Autism Spectrum Disorders receiving 20 sessions of qEEG-guided Neurofeedback showed a 40 % decrease in autistic symptoms compared to the control group. Moreover, their findings demonstrated a decrease in core symptoms and hyperconnectivity, an increase in metabolic activity as well as improvement

of attention, executive, visuospatial, and language functions in the treatment group. The researchers did highlight the need for long term follow up studies as well as randomised assignment of treatment and control groups.

In a recent study by Kouijzer, Moor, Gerrits, Congedo and van Schie (2009) using a nonrandomized waiting list control, seven children diagnosed with autistic spectrum disorders (ASD) received 40 sessions of Neurofeedback training with the aim of improving their level of executive control. Participants were pretested on qEEG, a range of executive function tasks and parents were requested to complete a communication checklist. After the 40 sessions of Neurofeedback training as well as three months later the participants were retested on qEEG, executive function tasks and communication abilities. The children of the intervention group showed substantial improvements in a range of executive function tasks after receiving Neurotherapy, while no such effects were seen in the control group (seven children with ASD who did not receive Neurofeedback training). The results of this study provide further evidence in support of the view that Neurofeedback training may hold particular value in treating children with ASD. Furthermore, a 12 month follow-up study revealed long term benefits of EEG Neurofeedback in the treatment of ASD were either maintained or increased (Kouijzer, Moor, Gerrits, Buitelaar et al., 2009).

2.1.6.d Depression

According to Sadock and Sadock (2007, p. 276), "Depression is a mental state characterized by feelings of sadness, loneliness, despair and low self-esteem". Both EEG and qEEG studies have shown that a high proportion of individuals with mood disorders display abnormal brain electrical activity (Hughes & John, 1999). Furthermore, EEG studies report that small sharp spikes and paroxymal events are often found, especially on the right hemisphere (Hughes & John, 1999). In addition, a general consensus in qEEG studies indicate that increases in alpha or theta power as well as asymmetry and hypocoherence in anterior regions appear most often in unipolar depressed people. Bipolar patients often display decreased alpha but increased beta activity (Hughes & John, 1999).

Davidson (1998) has reviewed substantial research documenting that depression is associated with a difference in activation between the left and right prefrontal cortex. It has been established that the left frontal area of the brain is associated with more positive affect and memories, in contrast with the right hemisphere which is associated more with negative emotion. It is argued that a biological predisposition to depression exists when there is frontal asymmetry with more alpha activity present in the left frontal region thus illustrating a neurological basis for depression.

A preliminary case study of two depressed individuals revealed that Neurofeedback resulted in the improvement of their depression. Other factors in their personality structure had also normalized. It was concluded that Neurofeedback could be recognised as an adjunct to psychotherapy (Baehr et al, 1997). A follow-up study (from one to five years post-therapy), of three out of six patients diagnosed with unipolar depression who had completed on average 27 Neurotherapy sessions, was carried out by Baehr et al (2001). Their findings posited that the three patients had not experienced clinical depression since their training and had further maintained this well-being over time. Hammond (2000, as cited in Hammond 2005b) completed research on a case study which he followed up eight and a half months later. He found that Neurofeedback resulted in the improvement of severe depressive symptoms. He developed a protocol for treating depression where he altered the frontal alpha asymmetry. In a later study Hammond (2005b) further researched this protocol in treating patients who were moderately to severely depressed. Seven of the eight participants completed the training with no other psychotherapeutic intervention. The seven patients who completed the Neurofeedback treatment showed significant improvements in mood.

Walker et al. (2006) investigated the effects of qEEG guided Neurofeedback in mood disorders in two case studies (one with bipolar and the other with depression). In the depression case study a 41 year old with drug resistant and chronic depression underwent Neurofeedback training and showed significant improvements and managed to overcome her depression for up to two years after the treatment. The bipolar case study was of a 1 year old man who did not show

improvements on various drug therapies, and he no longer had any severe depressive or manic symptoms after being treated with Neurofeedback.

Suffin et al. (2007) conducted a randomised, blinded and controlled study to investigate the clinical efficacy in using qEEG based medical treatments for major depressive disorder. The study thus aimed to compare the outcomes of individuals diagnosed with major depressive disorder treated under the current medical paradigm of physicians to the outcomes of patients diagnosed with this disorder where medications were selected based on the qEEG data. The study illustrated that six of the seven patients within the experimental group where pre-treatment qEEG data was available showed better clinical response to medications. In contrast, only one of the six patients within the control group where medication choice was not guided by qEEG data showed clinical improvement. Therefore demonstrating that pre-treatment qEEG can possibly predict the medication responses of patient.

Although, there has been some indication that Neurofeedback may be possibly efficacious in the treatment of depression (AAPB, 2008), further research in this field is necessary for it to be declared as an efficacious treatment.

2.1.6.e Anxiety

Anxiety is characterized as a diffuse, unpleasant and vague sense of apprehension. Anxiety disorders can be viewed as a family of related but distinct mental disorders which include panic attacks, obsessive-compulsive disorder (OCD), generalised anxiety disorder (GAD), posttraumatic stress disorder (PTSD) as well as specific or social phobias (Sadock & Sadock, 2007). EEG biofeedback qualifies for the evidence-based designation of being an efficacious treatment of anxiety disorders in general, however in the evaluation of the separate anxiety disorders; phobic anxiety, generalized anxiety and PTSD each qualify for designations as being possibly efficacious. This means that the studies done had sufficient statistical power in addition to having well identified outcome measures but there was a lack of randomised assignment to a control condition internal to the study (AAPB, 2008).

Passini et al. (1977) conducted one of the initial research ventures in assessing the efficacy in treating war veterans who presented with a variety of anxiety symptoms. In their matched control group study training was given to 25 anxious Veterans and compared to a control group of 25 Veterans seeking treatment at a Veterans Administration hospital. Results showed that the training produced significant changes in state and trait anxiety in the Neurofeedback group. An 18-month follow-up study (Watson, Herder & Passini, 1978) of these Veterans was published and findings revealed the same results of lower anxiety which further validated the enduring positive effects of Neurofeedback training on anxiety.

Vanathy, Sharma and Kumar (1998, as cited in AAPB, 2008) found applying Neurofeedback training to generalized anxiety to decrease symptoms. Agnithorti et al. (2007) conducted a study whereby they compared the efficacy of EEG Biofeedback and Electromyographic (EMG) biofeedback in treating Generalised Anxiety Disorder (GAD). The EMG biofeedback differs from EEG biofeedback in that it utilises a physical muscle relaxation type training whereas EEG biofeedback is based on one's brainwave activity. In the study 45 individuals diagnosed with GAD were randomly assigned to three different groups. The one experimental group received EEG Biofeedback training whereas the second experimental group received EMG Biofeedback training. The last group served as a control group and did not receive a treatment, however they were taught a relaxation technique. Both the EEG biofeedback and the EMG biofeedback treatments resulted in remarkable improvements in both state and trait anxiety whereas the control group did not exhibit significant progress (Agnithorti et al., 2007).

In a randomized controlled group study (Peniston & Kulkosky, 1991, as cited in Hammond 2005b) focused on chronic PTSD, 30 sessions of alpha-theta EEG biofeedback training were added to the treatment already provided by the hospital to 15 Vietnam combat veterans with PTSD. After treatment and at a follow-up with a control group of veterans who only received the traditional hospital treatment, it was found that all 14 of the veterans who had received the traditional treatment had experienced relapses, while only 3 of the 15 veterans who had received the Neurofeedback training as well as the traditional treatment had experienced relapse.

In another Veterans Administration uncontrolled study (Peniston, Marrinan, Deming & Kulkosky, 1993, as cited in Hammond, 2005b), 20 Vietnam veterans with chronic PTSD were randomly selected and given 30 sessions of Neurotherapy. Follow-up interviews indicated that 16 of the 20 patients reported no reoccurrence of PTSD symptoms and only 4 of which reported only a few instances in the recurrence of nightmares or flashbacks.

A recent study by Walker (2009) consisted of 23 patients who had received a diagnosis of PTSD. Each patient was required to assess their own level of anxiety over the past five years on a scale of 1-10. Thereafter, each had a qEEG examination. For each site where there was a presence of excessive high frequency beta, 5-7 sessions of downtraining were given. Ten Hz uptraining was also given at each site. Four of the 23 patients declined the Neurofeedback training and were therefore considered to represent the no-treatment control group. After the Neurofeedback training, the other 19 subjects were again asked to rate their level of anxiety on a scale of 1- 10, this was repeated one month after the training. The results of this qEEG- guided Neurofeedback training showed clinically significant reductions in the treatment group, while those four who were part of the control group did not experience any significant change in their anxiety. This study further provided evidence that qEEG-guided Neurofeedback appears to be more useful in the reduction of anxiety than non-qEEG-guided training (Walker, 2009).

A study carried out by Egner and Gruzelier (2003) investigated the validity of Neurofeedback training to enhance the musical performance of conservatoire students at the London Royal College of Music who where performing under stressful conditions. Two experiments were carried out. The first experiment was a pilot study and consisted of a group of students who received training on attention and relaxation related Neurofeedback protocols. Improvements were highly correlated with learning to raise theta over alpha band amplitudes. In the second study, these findings were replicated and a different cohort of students was randomly allocated to one of six training groups. These included; alpha/theta Neurofeedback; beta1 Neurofeedback; SMR Neurofeedback; physical exercise; mental skills training and the Alexander technique training, which is a technique involving postural tension and is commonly used amongst

orchestral musicians. The alpha/ theta training group showed significant enhancement in musical performance under stress and compared favourably to the alternative methods.

2.1.6.f Neurological Disorders/Epilepsy/Seizure Disorders

Neurotherapy has been found to be useful with all kinds of epilepsy, including grandmal, complex, partial and petit mal seizures (Hammond, 2006). In 1972 Sterman (as cited in AAPB, 2008; Hammond, 2006) demonstrated the efficacy of Neurofeedback training when a woman who had suffered from uncontrolled generalized tonic-clonic seizures for a period of seven years stopped having seizures completely following the training. Sterman (2000) reviewed 18 studies which reported clinical findings in the treatment of seizure disorders with Neurotherapy from the period of 1981 – 1996 in peer-reviewed journals. Results indicated that of a total of the 174 patients treated for seizure disorders, 82% demonstrated significant seizure reduction. The studies also found that there was a reduction in the severity of the seizures.

Studies by Kotchoubey et al. (1996) indicted that the self regulation of slow cortical potentials used during EEG feedback decreases seizure activity in individuals with drug resistant epilepsy. This effect was believed to be sustained and strengthened 6 months after treatment ceased (Kotchoubey et al., 1997). Kotchoubey et al. (2001) investigated three different groups of patients with refractory epilepsy. They compared patients who had received an anticonvulsive drug as well as psychosocial counselling, a group that learned control breathing and a group that had learned self regulation of slow cortical potentials. The study showed a significant decrease of seizure frequency in both the drug and the self regulation trial. Swingle (1998) further posited that SMR training can also be considered a useful tool in the reduction of pseudo seizures and thereby enhancing the social functioning of individuals when used in conjunction with psychotherapy.

Sterman and Egner (2006) describe a case study in which one hour treatment sessions were provided twice a week for six weeks and once a week for the next 30 weeks to a patient with severe seizure disorder. The patient's seizure rate declined progressively, his medication was reduced and he could resume work. Nonetheless, they point out that the epileptic patients tend to

approach this treatment only when other treatments have failed. Instead they suggest it can be seen as alternative to pharmacotherapy. Additionally, they believe that the studies on the effectiveness of Neurofeedback in epilepsy to date are disappointing. They attribute this to the fact that the research in this area is quite time consuming and work intensive and has not been pursued by the pharmaceutical industry.

However, the International society for Applied Psychophysiology and Biofeedback review the efficacy of Neurofeedback through the evaluation of various studies. It appears that they have increased the rating of efficacy in the treatment of epilepsy from "Probably Efficacious" to "Efficacious", thus indicating that further research to date has established Neurofeedback as a useful method in reducing seizure activity especially with unmanageable epilepsy (AAPB, 2004; AAPB, 2008).

2.1.6.g Alcoholism and Substance Abuse

According to the APA (2000, p. 191), "Substance-Related Disorders include disorders related to the taking of a drug of abuse (including alcohol), to the side effects of a medication, and to toxin exposure.

Penniston and Kulkosky (1989, as cited in Penniston, n.d./2009) established the Penniston/Kullkosky protocol when they conducted a study using Neurofeedback training for stress reduction in individuals with a substance use disorder. They increased the alpha and theta waves and reduced the fast beta waves which are associated with addictive behaviour. They compared the experimental group consisting of individuals with chronic alcoholism to two control groups, one with non alcoholics and the other with alcoholics who were receiving traditional treatments. It was found that alpha training produced a more relaxed state and the perception of better control over stress. In turn, this led to less stress related drinking and craving during recovery. When followed up 36 months after the treatment, the experimental group exhibited abstinence as well as a reduction of relapses, illustrating the sustainability of the Neurofeedback training (Penniston & Kulkosky, 1989 as cited in Penniston, n.d./2009).

Saxby and Penniston (1995) employed the aforementioned Peniston/Kulkosky protocol in private group practice to assess its efficacy in the context of such a practice and in general. Their sample consisted of 14 depressed patients (eight males and six females). Their study confirmed that the application of the Peniston/Kulkosky protocol lead to significant changes in personality variables contributing to the alcoholism as well as to a reduction of depressive symptoms. Moreover, they completed a 21-month follow-up within this study and reported a sustained prevention in relapse. Therefore, they concluded that Neurofeedback could be considered an effective therapeutic approach to both alcoholism and depression.

Winterer et al. (1998) in a replication of findings by Bauer (1994, as cited in Winterer et al., 1998) utilised the EEG in attempt to predict relapse patterns of 78 participants with chronic alcoholism. They found that excessive beta brainwave activity is a good predictor of relapse. Similarly, Bauer (2001) attempted to extend previous research on EEG studies regarding the prediction of relapse through utilising a larger sample (107 participants) which would give the study more statistical power as well as subgroup analyses. They promoted the value of utilising EEG findings to predict relapse when there is an excess in beta brainwave activity. Their study further added that the EEG results not only predicted relapse in alcoholic abuse, but in cocaine, or opiod dependence as well.

Burkett, Cummins et al. (2005) investigated the effects of adding EEG Neurotherapy to the treatment programme offered to crack cocaine addicts in an inpatient facility. The study included 178 individuals and significant changes were seen in the 87 patients who could be located and assessed 12 months after completing the Neurotherapy training. The results of this study revealed that the addition of EEG Neurofeedback training to drug treatment regimens may have real potential in the treatment of crack cocaine addictions.

Burkett (2005) found that when the EEG biofeedback was used with individuals who were addicted to crack cocaine there was a general pattern of improvement. Their study further suggested that it was beneficial in treating alcoholism. However, Burkett (2005) indicated that

further research is required to establish the actual benefits and more specific patterns of improvement.

In reviewing the possibility of applying brainwave technologies to substance use disorder in adolescence Trudeau (2005), believes that there appears to be a lack of research in this area. He suggests that case study reports are necessary to demonstrate the feasibility and use of this treatment. Moreover, Tredeau suggests that there is a need for controlled studies which compare Neurofeedback to other therapies. It is further posited that the treatment effects should not only apply to the substance use disorder, it should also apply to the comorbid disorders such as ADHD, and conduct disorder.

Sokhadze et al. (2008) in their review of current literature on the use of EEG and qEEG based Neurofeedback in treating patients with a substance use disorder; suggest that there are various gaps in the research thus far. They propose developing a wider range of treatment protocols, which take into account other factors related to substance abuse that may affect the brainwaves of the patients. This includes factors such as: whether or not the individuals are currently using, at a stage of withdrawal or at a stage of protracted abstinence; the types of drugs abused (stimulants or depressants); and comorbid disorders commonly associated with a substance use disorder.

2.1.6.h Traumatic Brain Injury

Neurofeedback is seen as a beneficial supplementary therapy in rehabilitation of individuals who have suffered from a traumatic brain injury (AAPB, 2008; Hammond, 2006). Thornton (2000) investigated the efficacy in utilising EEG biofeedback training in the rehabilitation of individuals with mild traumatic brain injuries (TBI). The study consisted of 32 subjects who had suffered a head injury and 52 who were classified as normal. At the initial stages all the participants were asked to perform an auditory attention task, a visual attention task and a memory task. The results indicated that EEG biofeedback plays a role in rehabilitating individuals with mild brain injuries and improves the memory function of normal individuals.

Schoenberger et al. (2001) conducted a small controlled study of 12 participants who had received a mild to moderately severe closed head injury within the preceding 12 months. The participants were referred to the study due to the occurrence of cognitive difficulties following the injury. It was concluded that an EEG-based therapy in the rehabilitation of patients with a traumatic brain injury resulted in improvements in some cognitive functions as well as reported features of depression and fatigue. Schoenberger et al., (2001) argue that even though Neurofeedback can be offered as a valuable additional therapy in assisting rehabilitation, continued research in this area is still needed.

In conclusion, the efficacy of Neurofeedback varies across the studies, with the treatment protocols for epilepsy and ADHD seemingly having the strongest empirical support. These are followed by those developed to treat anxiety and substance abuse (Angelakis et al., 2007). The use of Neurofeedback treatment for depression, traumatic brain injury, learning difficulties and autism continue to be investigated. Findings from various research studies indicate that the "long-term effects of Neurofeedback have been reported after six months and up to ten years post-treatment" (Angelakis et al., 2007, p. 113). Thus, the existing research suggests that Neurofeedback is a viable and promising option in the treatment of a number of disorders (Angelakis et al., 2007).

2.2 Perception

Cognitive perception refers to the way in which people process, interpret or assign meaning to the information they receive via the sensory systems (Jordaan & Jordaan, 2000). Social perception relates to "how people see or understand the meaning of things" (Donald, Lazarus & Lolwana, 2004, p 53). It is this latter type of perception that this study is concerned with. Perception is a complex construct. Art historian Ernest Gombrich (1977, as cited in Fourie, 2003) argued that when it comes to how we perceive things, objectivity is seldom present and the ways in which people perceive things involves "an intricate mechanism of expectation, selection, and decoding". He posited that "how we want and have been taught and conditioned to see things" is influenced by "a definite, culturally structured set" (p 484).

Human perception and knowledge formation are interlinking constructs that result in perceptual knowledge; individuals hold certain beliefs based on input factors according to Armstrong (1988). Perception is thus "nothing but the acquiring of true or false beliefs concerning the current state of the organism's body and environment" (Armstrong, 1988, p. 127). This statement brings to light the importance and implications of both truthful beliefs and bias beliefs held by individuals. Gaining insight into how people attribute knowledge and behaviour is important in gaining an understanding of their overall perceptions and knowledge. Essentially, this study aspires to gain insight into psychologist's perceptions in order to understand their behaviours, in other words; to explore why psychologists may or may not be willing to incorporate these technologies into their practices.

The Theory of Reasoned Action suggests that the decision to engage in a particular behaviour is the result of a rational process in which behavioural options are considered, consequences or outcomes of each are evaluated, and a decision is reached to act or not to act. That decision is then reflected in behavioural intentions, which strongly influence overt behaviour (Baron & Byrne, 2003). The Attitude-Behavioural Link proposes that our evaluations of aspects of the world, or our attitudes that are required from other persons through social learning, influence our behaviour. Thus, it is believed that attitudes influence our behaviours by shaping our perceptions of stimuli or events (Baron & Byrne, 2003). Thus, our perceptions are influenced by our attitudes towards something which in turn determines our behaviour. This suggests that if for example psychologists hold a negative attitude towards the brain technologies, it will affect the way they perceive any information relating to the technologies and will hamper their willingness to incorporate them into their practices.

A feature of perception is that it is a personal process which provides each of us with a unique view of the world (Steinberg, 1999). People may perceive the same thing differently (Donald et al., 2004).Therefore, psychologist's perceptions on their willingness to incorporate technologies are likely to differ somewhat. It is these perceptions of psychologists towards technologies used in the psychology profession that was of interest in this study as perception will have an effect on the willingness to incorporate these technologies. It was also important to explore these

perceptions because as Burton and Dimbley (1995) noted, perceptions can sometimes be faulty. Errors in perception can be described as false assumptions. Perceptions can sometimes be incorrect as not all the information needed is available or false connections may be made between things (Burton & Dimbley, 1995). Perception is a process by which knowledge is acquired of an objective world. Problems arise when the nature of this process and the subjectivity involved are considered, such as when "people try to make sense of the fact that in different circumstances the same things appeared differently, either to different people placed differently, or to the same person on different occasions"(Maund, 2003, p.1). This research sought to examine what psychologist's perceptions are and the implications these have in terms of their resistance towards EEG Neurofeedback and qEEG's.

> Neurofeedback is neither miracle nor panacea. It is science. But because the science is young and relatively unknown, because it turns the way we have categorised and thought about illness upside down, because it functions outside most frames of reference, it seems like "mumbo jumbo (Robbins, 2000, p. 3).

2.3 Resistance

Resistance is defined by the Oxford dictionary as the "dislike of or opposition to a plan or an idea" (Wehmeier, 2000, p. 1001). According to the dictionary of psychology, resistance is described as "any action that opposes, withstands or strives against a force" (Reber & Reber, 2001, p. 627). At its most obvious resistance can be seen as "a slow motion response to meet agreements or even a complete refusal to cooperate with change" (O'Conner, 1993, p. 30). Resistance by people is a way to say no to change. In the past the incorporation of any new technology or method into the medical or psychological field has been met with resistance (Stanovich, 2007). As this is a new technology which is highly scientific and slightly out of the field and scope of many psychologists, the question arose as to whether there would be similar resistance when incorporating this new technology.

According to O' Conner (1993) resistance can be intentional, unintentional, covert or overt. Resistance that is unintentional may be due to ignorance or a lack of knowledge regarding the change stimulus. Resistance can also be unconscious or conscious. When resistance is unconsciously motivated, the person does not realize that their behaviour undermines change. Rather their actions are based on inadequate or incorrect information, poor training or deeply ingrained habits from previously set work routines (O'Conner, 1993).

According to Piderit (2000, as cited in Oreg, 2003), resistance to change is multidimensional and consists of behavioural, cognitive and affective components. In his study on resistance, Oreg (2003) identified 6 sources of resistance to change:

1. Reluctance to lose control. It has been hypothesised that one of the main reasons for people to resist change is due to attempts to remain in control of a situation or of their lives (Oreg, 2003; Wheeler, Brinol & Hermann, 2007). In terms of psychologists resisting the incorporation of new technologies into their practices, these psychologists may feel threatened by the changes which these new technologies may bring because it means that their established patterns of working will change. Stanovich (2007) asserts that "the idea of a scientific psychology is threatening to some people. A maturing science of behaviour will change the kinds of individuals, groups and organizations that serve as sources of psychological information" (p. 198). Furthermore he posits that those who have long served as commentators in the field may resist any new knowledge that threatens their authority (Stanovich, 2007).

2. Cognitive Rigidity. Rigidity, close-mindedness and an unwillingness to adapt to new situations are involved in resistance (Oreg, 2003).

3. Lack of psychological resilience. Ashforth and Lee (1990, as cited in Oreg, 2003) as well as Judge et al. (1999, as cited in Oreg, 2003) are of the opinion that because change is considered as a stressor, those who are less resilient may be reluctant to make changes. It is further believed that those who resist change may do so because they feel that to make changes will be admitting that past practices were faulty and thus perceive change as loosing face (Kanter, 1985, as cited in Oreg, 2003).

4. Intolerance to the adjustment period involved in change. According to Kanter (1985, as cited in Oreg, 2003) people tend to be reluctant towards change as it requires more work in the short term. New tasks require learning and adjustment and it may be that some are reluctant to undergo the required adjustment period. "All change involves learning" (Steier, 1989, p29). The complexity of these technologies also requires that psychologists new to these concepts commit to reading and studying in order to become competent in the vast area of neuropsychology. Psychologists may feel they do not have the time to spend doing this (Evans, 1998).

5. Preference for low levels of stimulation and novelty. Kirton (1980; 1989, as cited in Oreg, 2003) "distinguished between those who are better at performing within a well-defined and familiar framework and innovators who are better at finding novel solutions outside the given framework" (p. 681). People are different in their receptiveness to change. Some individuals will adapt easily while others will resist anything new. According to Steier (1989) a person's interests, educational level and experience as well as demographic factors such as age, and contact with others in their particular environment may affect an individual's receptivity and capacity to change.

6. Reluctance to give up old habits. The reluctance towards change is related by some to the old adage of "familiarity breeds comfort" (Oreg, 2003). It is assumed that when individuals encounter new stimuli, they may find that their familiar responses are incompatible with the new situation. This then produces stress which is then associated with the new stimulus (Oreg, 2003). According to Stanovich (2007) psychological research is often criticised because people wish to avoid the implications that the new information may have as this would threaten their current beliefs.

O' Conner (1993) stated that there are five common causes of resistance.

1) Lack of belief that there is a serious need for change. "Psychologists, who traced their origins to philosophy rather than to biology, were not interested in physiological and anatomical approaches, directing their attention instead to behaviourism, psychophysics, and the psychoanalytic movement" (Kolb & Wishaw, 2003, p. 21). Resistance is a phenomenon that

causes delays in the field of a particular profession and this can be seen with regards to the field of neuropsychology. This attests to O' Conner's (1993) argument that unless people believe that there is a need for a certain change they will resist it. Furthermore, resistance that arises due to a lack of belief that there is a need for change often occurs when information is limited to people. With regards to Neurotherapy and qEEG, this is the case as much of the information, research and knowledge is limited to specialty arenas. Hughes and John (1999) maintain that the adoption of the qEEG within the psychiatric community has been slow and suggest that the reasons for this are to do with the fact that many articles are not included in journals due to "increasingly compressed curricula", while those that are published are often in specialized journals. Additionally, there has been considerable controversy about the clinical utility of qEEG that has been published by some professionals.

2) Different descriptions of the need for change. Resistance is believed to develop because those involved have a wide range of backgrounds and experiences and while they may all recognise that there is a need for change they tend to frame the problem or issue differently. The solutions chosen are then based on their own interpretation of the facts, thus there is a tendency to resist change because of a belief that it emphasises the wrong features of the problem. Additionally it is felt that the change is short-sighted, narrow and limited (O'Conner, 1993).

3) No agreement about the goals for change. Modern psychology consists of significant diversity of content and perspectives and it is this diversity that is believed to reduce the coherence of psychology as a discipline. Henry Gleitman (1981, as cited in Stanovich, 2007) characterised psychology as "a loosely federated intellectual empire that stretches from the domains of the biological sciences on one border to those of the social sciences on the other" (p. 2). It is this lack of theoretical integration that leads to the denigration of the scientific progress that has been made by some critics.

4) Lack of belief that the goal is attainable. Resistance that transpires from the belief that the goal is unattainable may be centred on the concern of whether the appropriate resources are available (O'Conner, 1993).

5) No confidence in the manager of change. When there is ambiguity, or the reasons for change are not clear, it is important that "individuals understand why a new way of doing things is preferable" (Steier, 1989, p. 27).

2.3.1 Psychology of innovation resistance

According to Sheth (1981) the two psychological constructs which appear most useful in understanding the psychology of innovation resistance are one's habit towards an existing practice or behaviour and the perceived risk associated with the innovation. He asserts firstly that one of the major determinants initiating resistance has to do with the strength of one's habit. "The stronger the habit towards an existing practice or behaviour, the greater the resistance to change and the innovations associated with that change" (Sheth, 1981, p. 276). The second key determinant of change is the perception of risk associated with the adoption of the innovation. Sheth (1981) discusses three major types of risks, namely: (a) aversive physical, social or economic consequences; (b) performance uncertainty; and (c) perceived side effects associated with the innovation. Again, it is postulated that the higher the perceived risk, the greater the resistance will be.

There are many possible reasons for resistance and it is therefore necessary to explore exactly what these are so that they may be addressed. Resistance can only be effectively dealt with once it has been discovered, thus it is necessary to investigate who is resisting and why. "Recognizing the source of resistance guides the development of better understanding" (O'Conner, 1993, p. 33). This study aims to encourage psychologists to give feedback and contribute ideas, both positive and negative about what their reservations are to these new technologies and suggestions they may have in order to aid in the incorporation of the technologies as well as any other difficulties they experience related to the technologies.

As these technologies would revolutionise practices in medicine, education and psychology, it is necessary to conduct well controlled research and publish the results to help ensure continued

and expanded acceptance of Neurofeedback training (Evans, 1998). Evans (1998) further posits that Neurofeedback training be greatly expanded in the work of children as this could serve as a means of prevention of later disorders.

Chapter Three: Methodology

3.1 Research Questions

In this study the research questions aimed to explore and describe the perceptions and resistance of psychologists to the use of particular brain technologies. The research questions are:

1) What are psychologist's perceptions of incorporating new technologies, such as EEG Neurofeedback and qEEG's, into their everyday practices?
2) What resistance to incorporating these new technologies is present?
3) What suggestions do psychologists have, which they perceive will facilitate them in incorporating these new technologies?

3.2 Method

3.2.1 Sample and sampling

Initially only Educational Psychologists were considered as the sample. However, due to the poor response rate it was decided to broaden the sample to include Clinical and Counselling Psychologists as well. The study was conducted in Gauteng. Psychologists of varying ages, race, education, work histories and levels of experience were included. The psychologists may be employed in schools, work in private practices or other institutions.

A sample of 50 psychologists was drawn using convenience sampling. This is a nonprobability sampling method whereby participants are selected on the basis of their availability and willingness to respond (Gravetter & Forzano, 2006). Nonprobability sampling is appropriate when the researcher's aim is to generate theory as well as a wider understanding of social processes (Gravetter & Forzano, 2006). Although, convenience sampling may be considered a weak form of sampling because of bias, it is an easier and less time consuming method, which is an important consideration given the time constraints placed on this research project (Gravetter & Forzano, 2006).

As this study is predominantly qualitative in nature, it was conducted using fewer subjects than would have been necessary in a quantitative study (Gravetter & Forzano, 2006). Because it was not possible to foresee the quality of the answers given on the questionnaires by the respondents, the sample size was chosen to accommodate for this.

3.2.2 Procedure

Firstly, an application for ethical clearance was obtained before the study was carried out. This included an information sheet (Appendix A) and consent form (Appendix B). An open-ended self- administered questionnaire was then designed for this study (Appendix C). Following this, a pilot study was conducted prior to implementing the formal research study. Pilot studies are employed to ascertain whether the relevant data can be obtained from the participant (Gravetter & Forzano, 2006). Subsequently, Dr Marita Brink, a psychologist who holds various training seminars for psychologists, was contacted telephonically and permission sought to hand the questionnaires out one morning at a training seminar. An information letter detailing the purpose and procedure of the study was provided (Appendix D) as well as a letter of consent to hand the questionnaires out at one of her training seminars. The researcher was present at the training seminar and verbally provided a brief introduction and description of the research and the technologies discussed in the information sheet and questionnaire to the participants. Participants were invited to complete the informed consent form (Appendix B), after which the questionnaires were distributed (Appendix C), completed by participants and placed in a sealed box which was collected by the researcher directly afterwards. Due to the fact that only three questionnaires were completed and returned at the seminar, it was decided to email psychologists in Gauteng asking them if they would mind completing a questionnaire. The psychologist's numbers were obtained using the Med Pages and each psychologist was contacted telephonically and asked if they were interested in participating. If the psychologist agreed to participate in the study they were emailed the questionnaire to complete. On completing the questionnaire, the psychologists then emailed or faxed their completed questionnaire back to the researcher. Any identifying details, such as names or telephone/fax numbers were removed in order to maintain anonymity and confidentiality. Data obtained was analysed quantitatively through the use of

frequency tables and pie charts as well as qualitatively by using thematic content analysis. The six steps proposed by Braun and Clarke (2006) for thematic content analysis were considered.

3.2.3 Research design

A mixed research design was used in this study as both qualitative and quantitative methods were used in the analysis of the data. The qualitative aspect of this study is descriptive and exploratory. In qualitative research the focus is on meaning, experience and understanding (Collins et al., 2000). A qualitative research design allows for questioning to be less directive and more open-ended. "By presenting people with a few carefully constructed questions, it is possible to obtain self-reported answers about attitudes, opinions, personal characteristics and behaviours" (Graveter & Forzano, 2006, p. 331). This study made use of a cross-sectional design as the data was collected at one point in time from each unit of analysis.

This research is located within an interpretive paradigm. Bailey (2007, p. 208) describes an interpretive paradigm as one in which the assumption is that there is "no objective social reality independent of the meanings given in a setting". The researcher was thus interested in the meanings, beliefs, ideas and feelings that were given to objects or activities by participants in the setting (Bailey, 2007). The present study investigated the meanings and perceptions that psychologists hold towards the various new technologies.

This study was inductive. Induction entails the "use of a relatively small set of specific observations as the basis for forming a general statement about a larger set of possible observations" (Gravetter & Forzano, 2006, p. 507). The findings regarding the perceptions and resistance towards new technologies experienced by psychologists participating in this study, brings to mind the question of whether all psychologists may express similar views and concerns. Thus, the findings of this group are tentatively generalized to a larger group.

3.2.4 Instrument

An open ended self- administered questionnaire was used. The questionnaire consisted of two sections. A copy of the questionnaire has been included in the appendix (Appendix C). The first section of the questionnaire consisted of eight questions dealing with biographical details. Gender, age, race, educational level and number of years in practice were addressed in this section. This section also included information on the psychologist's work place and registration category as well as some of the common presenting problems of their clients. The second section consisted of nine open-ended questions which focused on psychologist's understandings, perceptions and willingness to incorporate technologies, such as Neurofeedback and qEEG's, into their everyday practices. Psychologists were also asked to include any concerns they may have regarding incorporating these technologies as well as suggestions as to what would make the incorporation easier.

3.3 Data Analysis

The data was analysed using both quantitative and qualitative analysis methods. The results were first analysed using quantitative content analysis. In her analysis, the researcher focused on the repetition of words or phrases in respondents' answers and in doing so created a suitable coding frame which indicated the frequency of various themes extracted from the answers to each question.Descriptive codes were utilised. These entail attributing theme categories to the data (Wellman, Kruger & Mitchell, 2005)

The purpose of coding is to analyse and make sense of the data that have been collected and the researcher made use of this in order to organise the data information and to categorise it according to particular themes. Once the categories were defined, the data was then sorted into frequency tables (Wellman, Kruger & Mitchell, 2005).

Thematic content analysis was selected as the qualitative method of analysis for this study. "Thematic analysis is a method for identifying, analyzing, and reporting patterns (themes) within data" (Braun & Clarke, 2006). A theme is a recurring pattern, topic, viewpoint, emotion,

concept or event (Bailey, 2007). Emergent themes in this study regarding the psychologist's perceptions of and resistance to new technologies in their field were identified in relation to the research questions provided by this study and then analysed. The themes were derived according to the data and thus were more data-driven than theory orientated.

Thematic analysis provides a flexible and useful research tool which can provide a rich and detailed account of data (Braun & Clarke, 2006). Thematic analysis was carried out using the 6 phases proposed by Braun and Clark. These steps are as follows:

1) Familiarise oneself with the data

In order to become familiar with the depth and breadth of the content, it was necessary that the researcher immersed herself in the data by repeated and active reading of the data. During this stage the researcher searched for meaning and patterns within the texts. Thus, the researcher read through all the questionnaire responses with the aim of searching for patterns that emerged in the psychologist's responses (Braun & Clarke, 2006).

2) Generating initial codes

This phase involved the production of initial codes from the data. Codes are features of data that appear interesting or significant to the researcher. They are also the most basic element of raw data that may be assessed in a meaningful way according to the phenomenon being studied. According to Bailey (2007), thematic analyses work most effectively when themes are sought that address the research questions. Themes result from carefully coding the data by constantly comparing cases for similarities and differences (Bailey, 2007; Braun & Clarke, 2006). The researcher revised and categorised the responses of the participants in order to identify over arching themes. The researcher thus highlighted responses that were frequently seen within participants' questionnaires. Various differences within responses were also noted.

3) Searching for themes

This phase involved sorting the different codes into potential themes, and collating all the relevant coded data extracts within the identified themes. Essentially, it involved the initial analysis of the codes and a consideration of how different codes may combine to form an overarching theme. Thus, the list of the different codes identified by the researcher was sorted into potential themes (Braun & Clarke, 2006).

4) Reviewing themes

This phase involved the refinement of themes. It involved 2 levels: checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2). A thematic map of the analysis is then generated (Braun & Clarke, 2006). The researcher assessed whether or not the various data extracts appeared consistent within the theme itself as well as with the overall data. In doing so, the researcher determined whether a theme appeared logical through attempting to fit a thematic map into the data.

5) Defining and naming themes

This phase entailed ongoing analysis to refine the specifics of each theme, and the overall story that the analysis tells. In other words, the researcher needed to identify the essence of what each theme is about as well as determine what aspect of the data each theme captured. Clear definitions and names for each theme had to be generated (Braun & Clarke, 2006). Themes were initially identified through analysing the responses given by participants to specific questions, however, some questions resulted in similar responses and themes suggesting that these were part of an overarching theme, namely that psychologists generally perceive brain technologies to be useful to the field of psychology, however there is still resistance in incorporating these technologies for various reasons. Subsequently, the sub themes were characterised by possible reasons for resistance.

6) Producing the report

This phase involved the final analysis and write-up of the report. The task here was to tell the complicated story of the data in a way that convinces the reader of the merit and validity of the analysis. It is important to include enough data extracts to demonstrate the prevalence of the theme. Analytic narrative needs to go beyond mere description of the data and should make an argument in relation to the research question (Braun & Clarke, 2006).

3.4 Ethical Considerations

Ethical clearance was obtained before the study was carried out (See Ethical Clearance Certificate in Appendix E). Participants were informed of the exact nature of the study in the information sheet provided (Appendix A) and invited to participate in the study. Participants were also informed that participation was voluntary and that they could withdraw from the study at any time without any negative consequences. They were also informed that there were no benefits or consequences of participation. Confidentiality and anonymity was communicated prior to commencement and participants were required to sign an informed consent form, if they agreed to participate in the research (Appendix B). It was also communicated to participants that once the questionnaires were entered into a data set, and it was ensured that the data set was correct, raw research data will be destroyed. Before this, all data materials will be kept in a secure place in a filing cabinet under lock and key. Results of the study are reported in the research report. A summary of end results will be reported to the individual participants, should they be interested. Alternatively, the bound research will be available at the University of the Witwatersrand and participants may view the research through the university.

Chapter Four: Results

The results of this study will be presented quantitatively and qualitatively. The results will be reported quantitatively making use of tables and pie graphs. This serves to provide an informative grounding which assists in the interpretation of the qualitative results.

4.1. Biographical Information

The composition of the biographical details, i.e. sex, age, race, place of work, registration category, number of years in practice and academic qualifications, are reflected in Table 4.1 below.

Table 4.1 Participant's biographical information

	Frequency (n)	Percentage (%)
SEX		
Male	14	28%
Female	36	72%
AGE		
26 – 29 years	3	6%
30 – 34 years	2	4%
35 – 39 years	10	20%
40 – 49 years	18	36%
50 – 59 years	11	22%
60+ years	6	12%
RACE		
African	2	4%
Indian	2	4%
White	45	90%
Asian	0	-
Other (non-responder)	1	2%
PLACE OF WORK[1]		
Private Practice	47	94%
School	6	12%
Institution	8	16%

REGISTRATION CATEGORY		
Clinical	12	24%
Counselling	9	18%
Educational	29	58%
YEARS IN PRACTICE		
0 – 1 year	1	2%
1 – 5 years	13	26%
6 – 10 years	10	20%
11 – 15 years	10	20%
16 – 20 years	11	22%
20+ years	5	10%
QUALIFICATIONS		
M.Ed	9	18%
M.Ed plus teaching qualification	12	24%
MA	14	28%
Masters Degree plus other	6	12%
Doctorate	1	2%
Doctorate plus other	1	2%
Doctorate plus teaching qualification	7	14%

Note[1]: Some respondents worked in private practice and either school, institution or other

Figure 4.1 shows a graphic representation of the disorders that clients commonly present with according to the psychologists. The results indicate that common problems that the psychologists deal with in their everyday practices relate to learning difficulties and scholastic problems. Relationship difficulties or problems across the spectrum, from marital to family and friendship difficulties, are also commonly seen. Mood and anxiety disorders were also frequently reported.

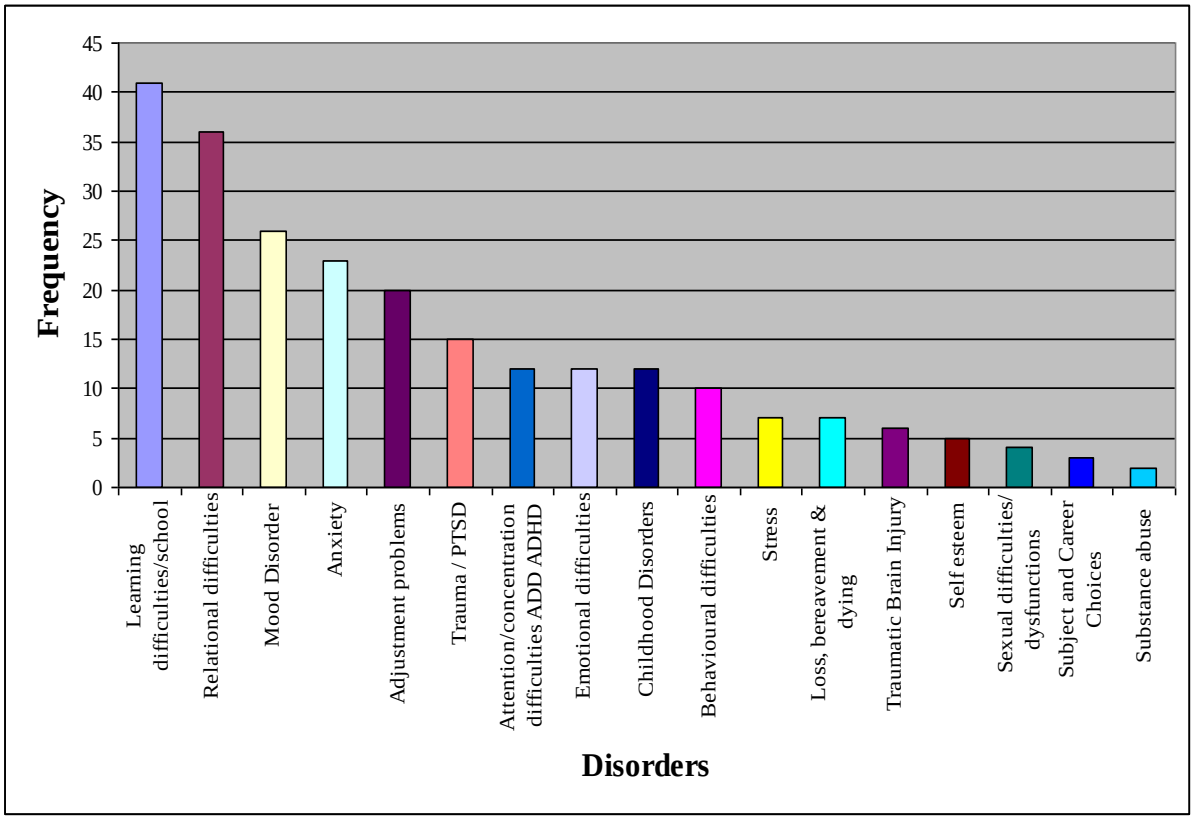

Figure 4.1 Common problems reported

4.2. Emerging Themes

4.2.1 Main theme

The main or overarching theme seems to be that psychologists generally do perceive brain technologies, such as EEG Neurofeedback and qEEG to be useful in the field of psychology. However, it appears that psychologists are nonetheless still resistant to incorporate them into their everyday practices due to a number of reasons, which will be discussed further on.

4.2.2 Sub theme one: Lack of knowledge and understanding of the technologies

Four categories were created according to the respondents' answers regarding their perceived knowledge and understandings of the technologies. This was presented in separate pie charts for

Neurofeedback and qEEG. In terms of the psychologist's knowledge and understanding relating to Neurofeedback, 2 respondents out of the total sample of 50 (4 %) reported having no knowledge of Neurotherapy. Respondent 49 reported: *"I Know nothing except that it is a technique used.* Respondent 46 stated: "*I have no knowledge at all".* These responses were placed in the category ***'No knowledge'.***

26 (52%) reported having very little or limited knowledge as evidenced by Respondent 20 who commented: *"My knowledge is very general and limited. The e-mail from the researcher stimulated my further internet based exploring"*. Respondent 1 answered: *"Limited knowledge -it involves the use of electrodes and certain brain functions are monitored".* Respondent 4 also indicated that her knowledge was limited in her statement: "*Very limited knowledge – it involves an EEG and is a biofeedback tool.* Keywords that frequently came up included: 'very little knowledge'; 'very limited'; 'not much information' and 'minimal'. Thus, the second category ***'Limited knowledge'*** was used.

17 (34%) stated that they had a good understanding of what Neurotherapy is. Respondent 27 defined EEG Neurofeedback as: *"Measurement of brain activity to determine brain scatter, anxiety (theta waves too high), depression (alpha waves too high). Then feedback is given visually and by audio means of brain states to allow the patient to adjust brain activity – this is a subconscious learning process. It normalises brain activity patterns".* Respondent 15 demonstrated that their knowledge or understanding of Neurotherapy was good as evidenced by the in-depth answer presented : *"Alternatively EEG Biofeedback, Neurofeedback or Neurotherapy was popularised in approximately the middle of last century. It concerns the conditioning of the brain –on classical and operant principles – to produce the desired cortical activity. What is considered normal or optimal activity is based on the growing database of other individual qEEG's. Useful in the treatment of learning difficulties, ADD/ADHD, management of epilepsy, relaxation, and so forth".* Another comprehensive understanding was offered by Respondent 48: *"It is a process whereby brain activity (as indicated by alpha, beta, delta and theta waves) is measured and relayed onto a computer screen. The hardware required are a computer and specific headgear which contain sensory electrodes, much like the usual EEG*

apparatus. The computer software creates a digital topographic representation of the brain activity and integrates it with a computer game interface (e.g. Beta wave activity is measured by the sensory electrodes and converted to digital info). This info is used, for example, to make a space ship on the computer screen move forward. The digital information from the game is then fed back into a headgear unit containing the sensory electrodes which monitor the brain activity. The rationale is that by using more beta wave activity, the participant can alter the computer representation on the screen. When concentration lapses and brain wave activity changes, the nature of the computer interface changes (e.g. the spaceship moves backwards or forwards). By monitoring how the computer interface changes, the client can choose to maintain focused attention and increase beta wave activity. The participant essentially trains brain function and changes brain activity to utilize these waves involved in concentration (beta)". A category labelled ***'Good knowledge'*** included the responses like those above, where it appeared that the respondents had a good understanding of Neurotherapy, based on the answers given.

The fourth category ***'Fair knowledge'*** was created as a result of some participants responding to the question by commenting: "Fair knowledge". It comprised 5 respondents out of the total sample (10%). It also included some of the responses whereby the respondent appeared to possess a reasonable knowledge regarding Neurotherapy but they did not elaborate enough or gave an opinion which made it difficult to determine how substantial their knowledge was. For example, Respondent 14 answered: *"An excellent way of training or retraining in cognitive development. Excellent to use with children, particularly for ADHD".* Similarly, Respondent 11 did not give much of an indication with regards to her understanding but stated: *"Useful but apparent benefits are exaggerated".*

Figure 4.2 below shows a graphic representation of these results.

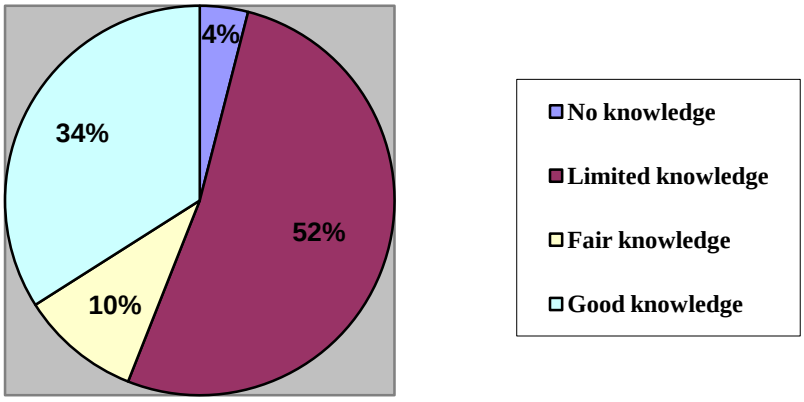

Figure 4. 2 Psychologist's knowledge and understanding of Neurofeedback

Again the four categories were utilised according to the participants' responses regarding their understandings offered on the qEEG and determined in the same manner as above. 17 (34%) out of the 50 respondents answered that they had no knowledge or understanding of the qEEG. These respondents were included in the category **'No Knowledge'.**

Twenty (40%) of the participants had a very limited or superficial understanding of the qEEG as can be seen from the following responses given by participants. The category **'Limited Knowledge'** contained these responses. Respondent 26 stated: *"I think I have heard about it once from a colleague. I think it is a computer-based system that uses feedback from areas of the brain that get activated as various parts of the brain are used to perform a mental task or skill. I think that it is used to train people to develop different brain activities and skills through finding ways to achieve certain computer tasks or operate games. I have heard of trying to move a ship on a computer screen through activating certain parts of the brain".* Respondent 20 offered the following: "*Very General and limited. I have a working knowledge of neuropsychology. Sufficient I hope to allow for a differential diagnoses in clinical practice but until prompted by the research questionnaire I had not explored it in any detail".* Moreover, Respondent 24 answered: *"Very superficial understanding of the process. I have read a few articles on this, but have never come across it in practice or seen it in use".*

2 (4%) of the respondents reported that their knowledge of Neurotherapy was fair and 11 (22%) participants indicated that they had a good understanding of what a qEEG is. The following are some of the responses offered by the participants included in the category **'Good knowledge'**. Respondent 3: *"Helps to pinpoint with greater precision the specific areas that are dysregulated, and therefore improves therapeutic outcome".* Respondent 15 stated: *"EEG recording at various points on scalp: Provides brain map. One can determine an average level of activity at each point and compare readings with a database – supposedly the norm over- and under activity for that location".* Respondent 27 provided this answer: *"An in depth EEG which is quantified and geographically localized to direct which brain elements require treatment and to focus treatment mechanisms to greatest effect"*. Respondent 33 reported: *"It is a quantitative EEG being done on the client. Results can assist the neurotherapist to identify which specific part of the brain needs to be treated. It can definitely serve to shorten the duration of therapy, as the therapist can work with the specific area without having to guess where the problem lies".* Respondent 41 gave the following understanding: *"Wonderful way of establishing neurological arousal level and brain patterns. Has the potential to zoom in directly and very specifically establish what type of training and/or medication may be required. This way, time and money and frustration are saved. Unfortunately, it is extremely expensive and not possible for most people who are in need of this. Medical aids reimburse only a fraction of the cost".*

This information is represented graphically in Figure 4.3.

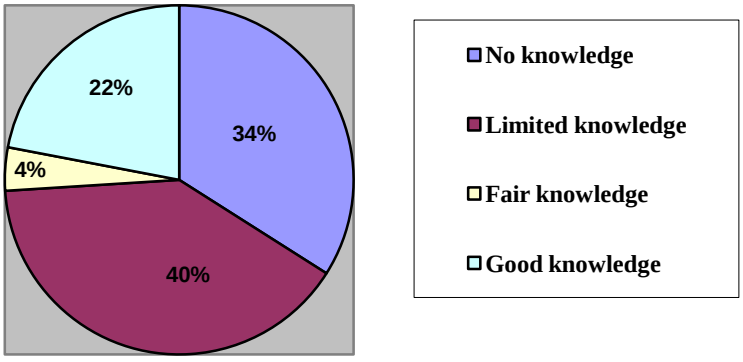

Figure 4.3 Psychologist's knowledge and understanding of qEEG

4.2.3 Sub theme two: Perceived utility of these technologies to the field of Educational Psychology

The categories developed were: ***'Technology is useful'***; ***'Technology may be useful'***; '***Unsure or don't know'*** and ***'Technology is not useful'***. Encouragingly, 31 (62%) of the 50 respondents perceive the technologies to be useful as can be seen by some of the responses offered by participants and these respondents answers were sorted into the category **'Technology is useful'.** Respondent 33 stated: *"Definitely! If you find that a child has a high delta activity during the day, and you can help him through neurotherapy to lessen that up through the activity of the SMR waves (12-18Hz), his daydreaming will be limited and he would be able to function optimally in class".* Respondent 30 answered: *"Absolutely, use it all the time in attentional difficulty cases".* Respondent 31 also appears to find the technology useful as indicated by the response given: *"Yes. Especially with assessments, learning difficulties and/or ability as a result of accidents".* Respondent 39 reported: *"Yes, it gets to the root of the problem. It specifically indicates where brain waves need to be changed so that problems can be sorted out at the origin. Namely in the brain itself, e.g. in ADD too much theta is produced in relation to beta waves. By rewarding the beta waves through operant conditioning more focus and concentration is achieved. A greater feeling of well-being is experienced and the sleep pattern is improved".*

7 respondents (14 %) said they thought it *may* be useful and were represented by the category **'Technology may be useful'.** Respondent 2 answered: *"They may well be useful but this is not my field of expertise".* Furthermore, Respondent 21 stated: "*I suppose they could be useful in the sense that they could provide information on neurological functioning, cognition and learning".*

Eleven (22%) of the respondents indicated that they were unsure or did not know enough about these technologies to answer or comment on whether they would be beneficial to the field of Educational psychology. These were sorted into the category **'Unsure or don't know'.** Respondent 34 answered: *"Unsure of the efficacy. More research is needed."* Respondent 28: *"I am unsure of this, as I am not in the Educational Psychology field; however I have concerns around consent issues. Which children will have access to these technologies? Only urban,*

affluent schools? Or will the research include children in less privileged urban settings, including rural schools?"

One (2%) respondent indicated that they did not feel that the technology was useful. Respondent 12 indicated the following: *"Don't think they are conclusive enough or scientifically proven to benefit or help long term".* (See Figure 4.4).

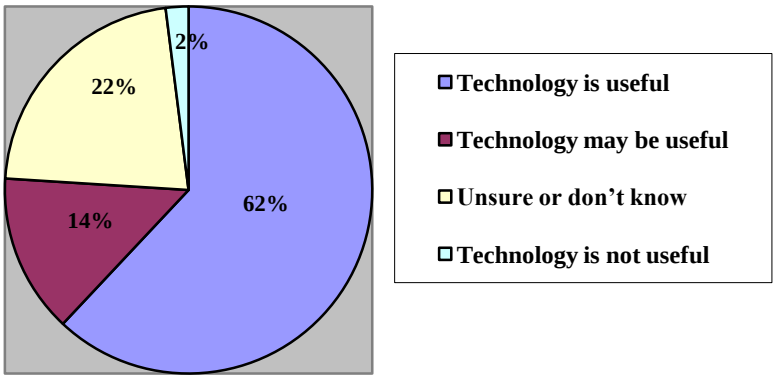

Figure 4.4 Perceived utility of the technologies

4.2.4 Sub theme three: Perceived benefits of incorporating these technologies into practices

Although it seems that knowledge on these technologies and their uses and benefits may be lacking and somewhat superficial, psychologists do however recognise that the incorporation of these technologies may benefit their clients.

Some of the perceived benefits are listed in Table 4.2 below:

Table 4. 2 Frequency table of perceived benefits of incorporating the technologies

Perceived Benefits	**Frequency**
Useful in improving concentration, addressing learning difficulties, relieving stress and anxiety. May also address difficulties caused by epilepsy.	13
Another tool, can be used for collateral information and as an alternative treatment for various disorders.	5
Gives further insight into the cognitive functioning of clients.	4
Able to monitor a client's progress as well as the effectiveness of medication and other interventions.	4
Shorten therapy and assessment time (Efficient).	6
Additional diagnostic tool and could assist in the differential diagnosis of temporal lobe epilepsy, borderline personality disorder and bipolar disorder.	2
Gives therapy more quantitative data and a more scientific approach to therapy (better insight into behaviour and academic problems).	3
Allows for an increase in the services offered to the clients, which may result in a gain in ones financial income.	5
Empowering for clients to see they have control over their own minds/bodies and allows them to understand themselves better.	6
Gives therapist a more holistic understanding of the client.	2
Cost effective as it offers a more permanent solution.	1
Neurological rehabilitation for traumatic brain injury	2
Enhancement of impulse control.	1
Seen as an adjunct to Occupational, Speech and Language therapy.	1

It appears that psychologists perceive these technologies as most useful in the treatment of attention, concentration and learning difficulties as well as epilepsy. This occurred 26 % of the time in the participant's responses.

However, some psychologists felt that they would not incorporate these technologies into their practices, some of their reasons for this follow in Table 4.3:

Table 4.3 Frequency table of psychologist's reasons for not incorporating the technologies

Reasons for not wanting to incorporate these technologies	**Frequency**
Incongruent with their approach to therapy and the issues they address in practice.	7
Fear of losing connection with the client as they view psychotherapy as more beneficial to the client.	2
Not a technician and may be difficult to use.	2
Age of psychologist.	1
Belief that there have been inconclusive results on the technologies and concerned about effectiveness.	3
Expensive equipment.	3
Inadequate knowledge of technologies.	2
Do not see any benefits.	5

4.2.5 Sub theme four: Resistance or willingness to incorporate these Technologies

The respondents' answers regarding their willingness to incorporate these technologies into their practices were sorted into the following categories: ***'Already in Use'***; ***'Willing'***; '***Unsure***' and ***'Unwilling'***. As reflected in Figure 4.5 below, 3 (6%) of the respondents indicated that they were already using these technologies and were sorted into the category '**Already in Use'**. Respondent 27: "*We already refer many clients for this treatment. Especially to gain focus in a client and reduce anxiety and depression*".

14 (28%) of them said they were willing to incorporate the technologies. These fell into the category **'Willing'.** Respondent 13: '*Definitely willing to incorporate any and all new approaches if they would assist me in therapy".* Respondent 39: *'I would incorporate neurofeedback because of its advantage in getting straight to the problem*'. Respondent 25: "*I would incorporate both if that helped my clients".* Respondent 47: '*Yes, EEG Neurofeedback because it will improve people's brain functioning and that is measurable. I would, for example, do a pretest and posttest to see the shift".* Respondent 24: "*I would be willing to incorporate both in assisting children and adolescents to be more aware of their responses and to learn to control their own responses".*

Eleven (22%) of the respondents reported that they were unsure as to whether they would incorporate the technologies and placed in the category **'Unsure or don't know'**. Respondent 26: "*I do not know. I really would have to learn more about them. I would be open to seeing a demonstration".* Respondent 37: "*I may consider using qEEG's in my practice. If I had enough evidence of it's accuracy in the confirmation of something like ADHD, it would be helpful. I am currently researching Evidence Based Practice and am therefore very aware of many alternative therapies and diagnostic media which have never really been tested in randomised controlled trials or double bind studies, yet they are sold as the panacea to the solution of many problems. South Africa is a developing country and we really cannot afford to waste our client's medical aid funds on dubious therapies".* Respondent 38: "*Willing but not convinced that me or my clients will be benefitted in a huge way".*

22 (44%) respondents said they would not incorporate these technologies into their practices as they had certain reservations about doing so. These were sorted into the category **'Unwilling'**. Respondent 16: "*No. I prefer using (1) the relationship and (2) the understanding, insight as my main approach".* Respondent 18: "*No. The unconscious cannot be mapped".* Respondent 10: "*At this moment, I know of no reason nor need of these technologies to be incorporated into my practice. My skills suffice in assisting all my patients. If needed I refer out or get assistance from other colleagues".* Respondent 8: *"At present I do not know enough about these technologies to warrant using them".* Respondent 44: "*No. Don't have any particular interest/passion. Also the*

cost to implement and number of clients needed to make such a venture financially viable - my practice is very small". Respondent 34: "No, *not yet. Because of reservations regarding efficacy and because I do not currently work with clients who are likely to benefit from it".*
Psychologist's concerns about the incorporation of these brain technologies are discussed more in depth further on. Figure 4.5 below represents this information.

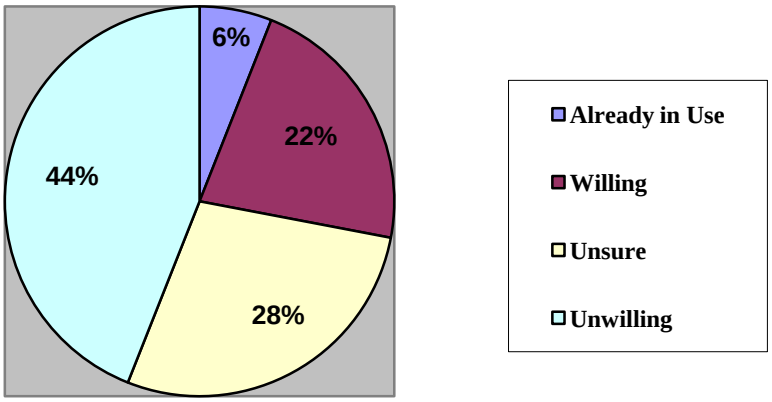

Figure 4.5 Willingness of psychologists to incorporate these technologies

4.2.6 Sub theme five: Psychologists have many concerns regarding the use of these technologies and these are influencing their perceptions of and willingness to incorporate them in their practices.

Table 4.4 Psychologist's concerns regarding the incorporation of brain technologies

Concerns	**Frequency**
Costs for equipment and training.	24
Time consuming.	6
Client's perceptions of technologies as harmful or as a "complete cure" to all their problems.	8
Possibly hindering the psychologist's emotional connectedness with the client (Seen as a medical modality).	9
Norms and Standardisation for the South African context.	2
Scientific evidence and research on the efficacy of technologies.	6
Perception that there is a lack of required expertise to work with the technologies.	5
Seen as inferior work to psychologists with a Masters or Doctorate Degree.	1
Practical value and value to clients.	5
Not congruent with the psychologist's chosen paradigm or practice.	6
Availability of adequate and accredited training with continued supervision.	8
Not regulated, thus open to misuse or exploitation.	6
Unavailable physical space.	1
Perception of these technologies as being a "fad" or a "Gimmick".	2
Ease in utilising the technologies.	1
Limited access to these technologies.	1
Inadequate knowledge to voice concerns.	4

4.2.7 Sub theme six: Experience of benefit

Responses to this question were sorted into three categories: ***'No'***; '***Yes'*** and ***'Yes- Have referred'***. When asked if they had experienced any benefits of using these technologies in dealing with clients, 41 (82%) of the respondents reported that they had not. Respondent 11: *"No, But others have charged an arm-and-a-leg for treatments incorporating this and then it is the assistant doing the therapy".* Respondent 25: "*I have never used them and have always thought that they are too costly for me to use, but have not really explored this*". Respondent 25: *No as I have never had access to them".*

Four (8%) of the respondents reported that they had experienced benefits in using these technologies with clients and were placed in the category **'Yes'.** Respondent 30: "Yes*, they have given clearer indications to validate other assumptions".* Respondent 33: "*Yes, I practice Neurotherapy and have had qEEG's done on some of my clients previously".* Respondent 39: "Yes, *The qEEG provides z scores which indicate where in the brain the problem lies. The Neurofeedback corrects the waves and this promotes better concentration and feelings of well being. The problem areas are quantified and the percentage of ADD is indicated together with reasons for this*".

5 (10%) reported that they had referred their clients for the treatment and had seen benefits of the training as a result. These were contained in the category **'Yes – Have referred'.** Respondent 3: "*Yes. I send them for Neurotherapy when I suspect attention problems".* Respondent 6*: "Yes, when I suspect Epilepsy I will refer for an EEG".* (See Figure 4.6).

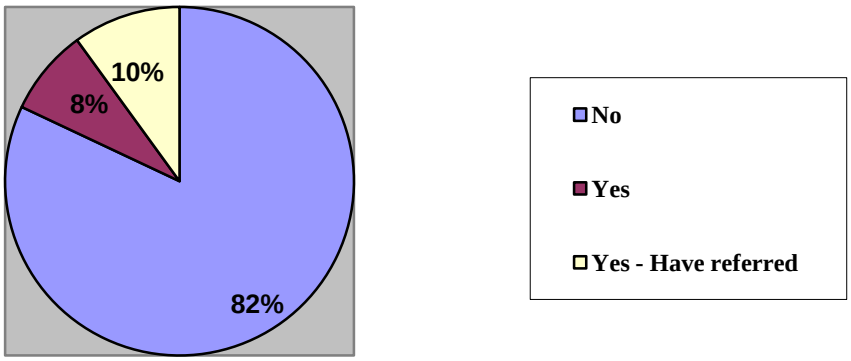

Figure 4.6 Experience of benefit

4.2.8 Sub theme seven: Perceptions on what is needed to assist in the incorporation of these technologies

The frequency table below (Table 4.5) illustrates what psychologists perceive will aid them in the incorporation of the technologies.

Table 4.5 Frequency table of perceptions on what would assist in the incorporation of brain technologies.

What is required to assist in the incorporation of these technologies	Frequency
Accredited training on the technologies.	18
Further knowledge about technologies.	9
Evidence for efficacy and benefits (Research).	9
More accessibility to information, equipment and supervision.	5
Exposure and marketing.	5
Funds to cover training, equipment and supervision expenses.	16
Physical space for the equipment.	5
Client interest and knowledge.	4
Additional professionals in practice.	2
Better relationship between neurologists and neurotherapists.	1
More experience with technology.	1
Not willing to incorporate into own practice at all.	11

4.2.9 Sub Theme eight: Psychologist's interest in receiving further training in these technologies

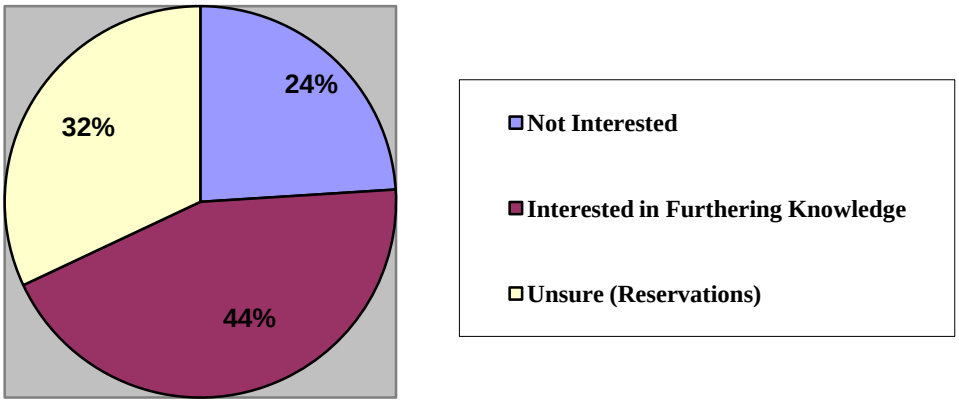

Figure 4.7 Psychologist's interest in receiving training

The following categories were used: '***Not Interested'***; ***'Interested in Furthering Knowledge'*** and ***'Unsure or have Reservations***'. As can be seen from Figure 4.7, it seems that psychologists are open to receiving further training and education in this area as 22 (44%) of the total sample of 50 respondents indicated that they would be interested in furthering their knowledge. These were sorted into the category **'Interested in Furthering Knowledge'.** Respondent 39: *I think it is essential and it would mean that fewer diagnostic tests are necessary to solve the problems we face. No language bias or education bias is present. It is scientific. Medication has harmful side effects while Neurofeedback is permanent and has no side effects".* Respondent 36: "*I would be happy to receive further training, if it was accessible, feasible, internationally accredited and affordable".* Respondent 13: "*Would like further training if not too costly and time consuming".* Respondent 2: "*It is certainly a field of interest but time, cost and relevance of training to my particular practice would need to be assessed".* Respondent 27: *"Would love to do this as soon as I can afford it."*

Sixteen (32%) of the respondents were unsure if they would want to receive further training or education due to the reservations they have about the technologies. These respondents fell into the category **'Unsure (Reservations)'.** Respondent 1: *"I would need to research further and know more about how the tools are used and for which clients and see if it applies to my practice".* Respondent 34: "It *depends on whether I would be convinced whether it would add value to clients' lives and would be effective".*

12 (24%) respondents reported that they were not interested in further education and training. These were sorted into the category **'Not Interested'.** Respondent 6: *"Not interested because of my age".* Respondent 16: "Not *interested as I prefer to use other therapeutic interventions".*

4.2.10 Sub theme nine: Psychologist's suggestions

The last question in the questionnaire afforded psychologists the opportunity to express any comments about the study or technologies as well as any suggestions they had in order to facilitate the incorporation of the technologies into their practices. Only 18 (36%) participants answered this question. Of the 18 responses, 6 (33%) of the comments were of a positive nature whereby participants conveyed an interest in receiving more information about the technologies. 10 of the 18 responses (55%) provided by the psychologists included suggestions. In terms of the participant's suggestions, 2 (11%) of the psychologists stated that increased media exposure or advertising would assist in the general public as well as professionals becoming more informed about the technologies, 4 (22%) suggested that the provision of CPD (Continuing Professional Development) accredited courses may help and 3 (16%) felt that stricter control and regulation by a recognised board would promote the credibility of the field. Another 2 (11%) psychologists proposed that a possible solution to the high costs involved in obtaining the equipment may be for groups of qualified individuals to rent the equipment, thus making the technology more accessible.

Chapter Five: Discussion

5.1 Biographical Information

36 (72%) of the 50 psychologists were female and 14 (28%) male. Statistics provided by the Health Professionals Council of South Africa reveal that 63 % of psychologists in South Africa are women. Therefore, the fact that the study consisted of more female participants is probably attributable to this fact. The majority (78%) of psychologists were above the age of 35 years. This may have affected the results as it appears that with age, resistance to new technologies may increase. It is the opinion of Evans (1998) that many of the professionals who attend Neurofeedback conferences tend to be middle-aged and he attributes the relative lack of younger persons to the pervasive views amongst university professors or mentors who regard Neurotherapy as lacking credibility and efficacy and further see it as a field in which ones professional growth will be short-lived. Of the total sample of psychologists, 58% were Educational Psychologists. The bias towards Educational Psychologists in the sample was as a result of the fact that the study initially only included Educational Psychologists.

5.1.2 Common disorders reported

The disorder most frequently reported by psychologists, in terms of what their clients present with, was learning or school related difficulties. This may be because Educational psychologists were better represented. Relational, mood and anxiety problems were also reported as common. A large body of research exists on the efficacy of using Neurotherapy in the treatment of learning, mood and anxiety disorders and thus it was unexpected that psychologists dealing with these common disorders had not given much appraisal to the utility of these technologies.

5.2 Emerging Themes

5.2.1 Main theme

The main theme that emerged in this study linked to the perceptions of psychologists regarding the brain technologies. It appears that while psychologists do perceive Neurofeedback and qEEG technologies to be useful to the field of psychology, they are hesitant and are not yet making use of them. The results of the study revealed that of the total sample of psychologists, only 6% were currently using the technologies.

5.2.2 Sub theme one: Lack of knowledge and understanding of the technologies

In line with the first research question which was to ascertain psychologist's perceptions of Neurotherapy and qEEG, the results of the study indicated that psychologist's knowledge or understanding of EEG Neurofeedback seems to be somewhat limited as was reported by 52 % of the respondents. Thirty four percent reported a good knowledge or understanding, 10 % stated their knowledge was fair and 4 % said they knew nothing of this technology. In their responses, some psychologists indicated that they had heard about Neurofeedback but had not seen it in practice, while others reported that they had no understanding of the technologies as they were not interested in it. Those who reported to have a limited understanding appear to know that it is a Biofeedback tool but do not know the specifics. One respondent confused Neurofeedback with Biofeedback. Others mentioned that they knew only what was provided to them in the introductory research letter.

Psychologists' current knowledge base on these technologies indicates that more psychologists know about EEG Neurofeedback than they do of qEEG as the results revealed that 74 % of the psychologists posses little or no knowledge of qEEG. This is probably as a result of the qEEG being the newer of the two technologies.

It needs to be noted however that the questionnaire did not ascertain how much knowledge the respondents possessed, or what the differences were in terms of having a '*fair knowledge or understanding'* of the technologies compared to '*a relatively good understanding or knowledge'.*

Therefore, this limitation in the study needs to be taken into account and considered when analysing the data.

As was posited by Hughes and John (1999) the possible reasons behind psychologists' lack of knowledge in these areas may be due to the fact that many research papers are published in specialty journals of which the majority of psychology professionals are not exposed to. A further explanation may lie in the controversy which has loomed over this field and which has as a result negatively affected it (Hughes & John, 1999). The following statement pays tribute to the negative perceptions towards this field that are held by some.

> Neurofeedback could not withstand the multitude of claims made for its efficacy. The modality quickly became associated with the psychedelic, altered states on consciousness movement that was perceived as a fringe element of scientific psychology. It is not surprising then that it only required a few negative findings for Neurofeedback to fall out of favour with the mainstream psychological community (Budzynski, 1999, as cited in Masterpasqua & Healey, 2003, p. 653).

According to Evans (1998) another reason the technique fell into disrepute was because it was associated with 'mind-control'. It thus appears that the remnants of these unfortunate proceedings in the past are still colouring people's perceptions of the technologies today. Thomas (n.d/2009) further states that while the field is steadily making a recovery and growing, many health professionals such as psychiatrists, psychologists and family physicians remain unaware of current developments in the field despite the new information that is being collected and published.

Duffy (as cited in Midwest Neurofitnes, n.d/2009) of Harvard Medical School appears to envisage a primary barrier to the acceptance of these brain technologies by professionals as being a tendency to offer opinions on a subject about which their knowledge is very limited.

> In a brief survey of the neurologists in and about our institution, not one had a grasp of the literature (research) yet most had negative opinions…The microcosm of opinion suggests the view that…many critics may be quite ignorant of the real data and/ or theoretical underpinnings of Neurofeedback and overly sensitive to self perpetuating common wisdom (Midwest Neurofitnes, n.d/2009).

This statement tends to suggest that ignorance to the literature and brain technologies may be a significant hindrance to the growth of the field and that perhaps psychologists are making their minds up prematurely about these technologies before they have considered all the necessary facts.

Two psychologists in the sample (4%) indicated that they had no knowledge on these technologies purely because they were not interested in them. O' Conner (1993) describes ignorance or a lack of knowledge to a change stimulus as a form of unintentional resistance. It can further be postulated that interest in the technology may be linked to how much knowledge or understanding a psychologist will be prepared to acquire.

It is also noted by Steier (1989) that a person's receptivity and capacity to change may be affected by their interests, educational level and experience, demographic factors, such as age and contact with others in their particular environment. In keeping with Sheth's (1981) notion that new ideas and technologies involve a certain degree of risk, it may be postulated that psychologists may find the incorporation of the new brain technologies disconcerting, especially because investing in these technologies is not a cheap endeavour. Furthermore, psychologists may be resistant because they do not see the benefits and rewards of incorporating these new technologies as they feel the troubles involved outweigh the benefits.

5.2.3 Sub theme two: Perceived utility of these technologies to the field of Educational Psychology

While their understanding and knowledge of the abovementioned brain technologies appeared to be limited, it seems that a large percentage of psychologists (62%) deem these brain technologies to be particularly useful in treating ADHD, attention or concentration difficulties, learning difficulties or as an adjunct in assessments. Additionally, they consider these technologies to be beneficial in the treatment of anxiety or stress disorders as well as in learning self-control and how to modulate ones own thoughts, behaviour and emotions. Nonetheless, results indicate that psychologists may not be quite ready to incorporate the technologies as they have various concerns regarding them.

Even though there are a number of psychologists who possess some knowledge on the research that has been conducted, it appears to be quite superficial. This may be due to the fact that access to this research is not made accessible enough. This is a barrier as it is felt that the endeavour is too costly to explore without sufficient research.

5.2.4 Sub theme three: Perceived benefits of incorporating these technologies into Practices

A frequent benefit noted by the psychologists was that these technologies would assist in reducing therapy and assessment duration. Moreover, psychologists recognised that a further benefit of these technologies resides in the assumption that they are empowering for the clients. It is believed that clients have control over their own minds/bodies and this aids them in gaining a better understanding of themselves. Additionally, psychologists felt that the incorporation of these technologies into practices would allow for increased services being offered to clients and possibly even an increase in income for psychologists. It was also perceived as beneficial as it is another tool that can be used for collateral information as well as an alternative treatment for various disorders.

Results illustrate that some psychologists do not perceive the use of these technologies as useful and thus are not incorporating the technologies into their practices. They view it as incongruent with their therapeutic approach or feel that it does not cater to the needs of the clients they see.

Schneider, Backes and Mathiak (2009) recognise the fact that the convincing success of imaging tools have not always necessarily led to the adoption of them. However, they argue that these technologies can offer a great deal in terms of research. Not only can they increase our understanding of brain disorders (Schneider et al.), but as Linden (2006) maintains Neurofeedback and qEEG provide a tool for the evaluation of therapy effects and enable the clinician to select optimal treatment suited for each individual.

5.2.5 Sub theme four: Resistance or willingness to incorporate these technologies into practices

The second aim of this study was to consider the resistance of psychologists towards the incorporation of these technologies into their practices. The results specified that 44 % of the psychologists were unwilling to incorporate the technologies, indicating that some resistance is present. Twenty two percent indicated that they were unsure as to whether they would consider using the technologies at this stage as they have reservations about doing so that need to be addressed before they would incorporate the technologies. Only 6% of psychologists are currently using these technologies in their practices.

It may be postulated that psychologists are doubtful towards the incorporation of these technologies as this would then necessitate a change in their current ways of thinking and practicing. To some this is threatening as it implies a sense of loss of control. This is in line with Oreg's (2003) statement that in order for people to attempt to remain in control of their situations and lives, they resist change. This is further supported by Stanovich's (2007) claim that people often tend to oppose new information that potentially threatens their current beliefs.

The results also suggest that psychologists are also unresponsive due to the fact that in order to successfully employ these new technologies they will have to undergo training and become familiar with a new skill or task. Steier (1989) maintained that people who resist change may do so in order to avoid the short- term work initially involved in responding and adapting to that which is new or unfamiliar. More importantly, as was stated by Evans (1998), and confirmed by the participant's responses, psychologists do not possess the time necessary for the extensive training and supervision that is required as the learning curve in these technologies is exponential.

Additionally, O'Conner (1993) argues that unless people recognize a serious need for change they will resist it. Some respondents indicated that their current therapeutic approach was adequate and thus they did not feel the need to include the technologies in their therapy.

It is maintained by Oreg (2003) that resistance arises out of a belief that something is not attainable due to the lack of availability of adequate resources. In the case of training in Neurofeedback or qEEG, psychologists appear to be hesitant as the training is not offered in institutions, such as universities. A respondent commented that the training currently offered only consists of a few days and that it should rather be offered as part of a Masters course. There seems to also be some concern regarding whether they would receive the adequate supervision needed. Added to this are concerns centred on the financial implications, for example the cost of the training, the cost of the equipment and then having to pay for ongoing supervision. There is also apprehension about the technical and advisory support that would be required.

5.2.6 Sub theme five: Concerns regarding these brain technologies

The participants indicated that in order to assist in the incorporation of these technologies, they would require more knowledge and information on them, which includes more research relating to the efficacy of Neurofeedback and qEEG. Yet again this strengthens the argument that by publishing articles in specialised journals, ignorance of Neurotherapy and qEEG's is promoted (Hughes & John, 1999). It is primarily as a result of people not having sufficient knowledge that

causes resistance to that which is unknown (O' Conner, 1993). It is further stated by Evans (1998) that there is a growing need to increase awareness and knowledge on Neurotherapy by ensuring that clinical and small group research findings are published in a variety of journals.

It is not only essential that psychologists are knowledgeable with regards to these brain technologies but the general public as well. Some psychologists indicated that better knowledge on the part of society about what Neurotherapy entails is needed in order to aid in the incorporation. This suggests that some professionals may feel that it is not viable to use Neurotherapy in their practices until the general public is more open to it.

Psychologists appear to feel that the training currently offered on these technologies is insufficient. There also tends to be apprehension with regards to having adequate skill in the use of these technologies present amongst psychologists. For example, one respondent stated that in order to interpret the EEG information one has to be a neurologist.

Further concerns relate to the costs of the equipment and training and also include the fact that medical aids do not fully cover this treatment and reimburse only a fraction of the cost. It is felt that the costs of these treatments are too much for the average South African. Evans (1998) suggests that those with academic affiliations can assist in overcoming negative perceptions and bias towards the field through the introduction of special graduate level courses on Neurotherapy or by the insertion of these into already well established courses on therapeutic techniques. He also maintained that the acceptance of Neurotherapy by health maintenance and insurance organisations may assist in gaining the recognition and credibility the field needs (Evans, 1998).

An added area of concern pertains to accreditation and the fact that Neurotherapy is not recognised or regulated by the HPCSA as well as the fact that there are people abusing it. Hammond (2006, p.7) states that "an increasing number of unqualified and unlicensed persons are managing to obtain Neurofeedback equipment and seeking to basically practice psychology and medicine without a license". This coupled with the fact that South Africa lacks a regulatory board to oversee

the use of these technologies opens the field up to criticism and threatens its credibility (Evans, 1998; Hammond et al., 2004, Hammond, 2006; Sterman & Egner, 2006).

It is further seen as a medical modality and psychologists are hesitant as they feel that these technologies may hinder their emotional connectedness with their clients. Concerns were also reported around the clients perceptions of the technologies as either harmful or as a complete cure to all of their problems.

The results of this study indicate that the principal concern and barrier to the incorporation of these technologies into practice by psychologists is centred on the costs of equipment and training as well as the availability of adequate and accredited training with continued supervision.

5.2.7 Sub theme six: Experienced benefit of using these technologies in dealing with Clients

Taking into consideration the fact that many psychologists (82%) have either not incorporated or used these technologies, it makes sense that the majority of them have not experienced the benefits of using them when dealing with clients. It is encouraging that some psychologists (10%) are at least referring their clients for training, even if they are not directly incorporating the technologies into their own practices.

Neurotherapy is described as an emerging modality that holds great promise in becoming part of effective psychological practice. Its potential has unfortunately been disregarded by mainstreams clinicians. It is argued that this technique which combines operant conditioning and brain function should be given greater attention amongst the psychological community (Masterpasqua & Healey, 2003).

5.2.8 Sub theme seven: Perceptions on what is needed to assist in incorporating these technologies into practices

The third aim of this research was to look into what psychologist's perceived as necessary in order to facilitate in the incorporation of the brain technologies. According to the results, psychologists seem to feel that accredited training, further knowledge and research on the efficacy and benefits of the technologies as well as the funds to cover training, equipment and supervision expenses are needed to assist in the incorporation of these technologies. However, some of the psychologists still maintained that they were not willing to incorporate the technologies.

5.2.9 Sub theme eight: Interest in receiving further training on these brain technologies

Whilst 44% of the psychologists indicated that they are interested in receiving further education or training in this area, they also emphasised that the training and education needs to be more affordable and accessible. A major problem exists as a result of Neurotherapy and qEEG not being offered as part of formalised programmes in South Africa. It seems that perhaps people would be more open to it if it was offered as part of psychologist's training. Furthermore, Neurotherapy as a profession does not have a distinct category of its own under the HPCSA.

Masterpasqua and Healey (2003) encourage psychologists to educate themselves more fully with regards to the potential of Neurofeedback. They maintain that in teaching clients to self-regulate this can become an important part of therapy.

5.2.10 Sub theme nine: Psychologist's comments or suggestions

Few psychologists responded to this question. Of those who did respond their suggestions maintained that accredited training on the technologies, further evidence for efficacy and more information on the technologies may possibly assist in the incorporation of these technologies.

This pertained to the third aim of the study which was to explore the suggestions psychologists had regarding what they perceived to be needed in order to make the incorporation of these technologies into their practices easier.

In summary, the results from this study suggest that within the South African context, psychologists in general do perceive the Neurofeedback and qEEG technologies to be useful to the field of psychology. However, they are currently not employing the use of these technologies into their current everyday practices due to a number of reasons. The results point to a limited understanding or knowledge of these technologies as a result of the difficulties in having adequate access to published research. Furthermore, while the majority of the psychologists in the sample indicated that they did perceive the technologies to have benefits and utility in the field of psychology, they did express a number of concerns centred around the costs of equipment, a sense that the training and supervision needed was unaffordable as well as a need to have a regulatory board in South Africa. These concerns are a major contributory factor to the resistance towards or unwillingness of many psychologists to incorporate the technologies into their everyday practices.

5.3 Conclusion

The aim of this study was to gain an understanding of the perspectives, attitudes, knowledge and perceptions of psychologists in order to explore the resistance towards incorporating these technologies into everyday practices. The first research question enquired about psychologist's perceptions of EEG Neurofeedback and qEEG. The results evidenced a lack of knowledge and understanding of the technologies. Psychologists did however report that they did perceive the technologies to be useful in the field. The second research question aimed to investigate the resistance that may be present by professionals in psychology towards the incorporation of these technologies into their practices. From the results, it appears that resistance is present and that it is mainly the consequence of a number of concerns psychologists have about these technologies. These concerns included training and equipment costs, accreditation and a need for more research on the efficacy of the technologies. In light of the concerns expressed by psychologists, and in line with the third research question which focused on what the psychologists perceived as necessary in

assisting them with the incorporation of these technologies as well as suggestions or comments made by the psychologists included increased media exposure, CPD accredited courses, recognition of these technologies by the HPCSA as well as psychologists possibly sharing the costs of equipment by renting it. It is also necessary to ensure that information and research pertaining to these technologies is made more accessible.

The limited current use, poor knowledge and negative perceptions bring to light important issues that illustrate the need for changes to be made if Neurotherapy and qEEG are to make an impact in South Africa. Knowledge on these technologies is limited amongst the professionals as well as within the public domain. It is vital that research on the benefits and uses of these technologies is made available to both professionals and the public in order to combat the negative perceptions around Neurotherapy and qEEG. Access to and use of these technologies in South Africa needs to be appropriately regulated, which is a great area of concern at present as there are individuals who are abusing the technologies. Additionally, recognition of these technologies by the HPCSA will assist in achieving the appreciation that this technology deserves.

5.4 Limitations of the Study and Recommendations

The following limitations were identified:

1. The sample size of this study was small and therefore generalisations to the population of psychologists in South Africa cannot be made.

2. Originally, this study aimed to look into the perceptions of only Educational Psychologists; however the sample had to be expanded to include Clinical and Counselling Psychologists due to the fact that not enough questionnaires could be collected using only Educational Psychologists within the time constraints. It is suggested that the research is repeated within each group.

3. The nature of the questionnaire in the current study was another limitation.

a) Future research may employ the use of interviews in order to gain a richer and more in - depth source of information into the resistance and perceptions of psychologists as some of the answers given on the questionnaires were limited and superficial.
b) Alternatively, future research could use a likert-scale if another questionnaire were to be designed as it was difficult to ascertain exactly how much knowledge and understanding the participants had of the brain technologies. For example, when psychologists stated that their knowledge or understanding was 'fair', the researcher was not able to sufficiently examine what the difference between a 'fair knowledge or understanding' and a 'good knowledge or understanding' was.

4. The majority of the psychologists who participated in this study were White and thus not representative of the whole of the South African population. A study comparing the perceptions of the different racial groups in South Africa is thus warranted.

5. An investigation of the relationship between psychologists' resistance to the technologies and their chosen theoretical paradigm could be a further avenue of exploration for further research.

6. A further study could investigate the relationship between psychologists' perceptions and knowledge of these technologies and their interest in them.

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Appendix A: Subject Information Sheet

Psychology
School of Human & Community Development
Private Bag 3, Wits 2050, South Africa. Telephone: +27 11-717-4500/2/3/4. Fax: +27-11-717-4559

Dear psychologist

My name is Tracey Hall. In partial fulfillment of completing my Masters Degree at the University of the Witwatersrand I am conducting research on **psychologists' perceptions of and readiness to incorporate technologies, such as EEG Neurofeedback and Quantitative Electroencephalograms (qEEG), into everyday practice.** This study aims to gain an understanding of your perceptions and willingness to incorporate these technologies (which are easily accessible) into your practice. Furthermore it seeks to explore any suggestions you may have which you perceive will make the incorporation of these technologies easier. Neurofeedback is a training procedure designed to enhance efficacy of brain function. It is a form of biofeedback that utilizes EEG technology to monitor brain activity. Electrodes are placed on the scalp and the EEG signal is processed and presented to the client in the form of a simple video game. Quantitative Electroencephalography (qEEG) is the measurement, using digital technology, of electrical patterns at the surface of the scalp which primarily reflect cortical activity or "brainwaves". A multi-electrode recording of brain wave activity is recorded and converted into numbers by a computer. These numbers are then statistically analysed and are converted into a colour map of brain functioning. This questionnaire asks for your opinion regarding the incorporation of these technologies into your practice.

I would like to invite you to participate in this study. Participation in this research will entail completing the attached questionnaire. The questionnaire will take approximately 10 minutes to

complete. Participation is voluntary, and you will not be advantaged or disadvantaged in any way for choosing to complete or not complete the questionnaire. No identifying information will be asked for and you will remain anonymous. Your completed questionnaire will only be seen by myself and my supervisor.

If you do choose to participate in the study please complete the attached questionnaire as carefully and honestly as possible. Once you have completed the questionnaire I will personally collect it.

Your participation in this study would be greatly appreciated. This research will contribute to a larger body of knowledge regarding the perceptions of resistance towards incorporating technologies into practice. This information will be useful so that issues regarding the incorporation of technology can begin to be understood.

Kind Regards

Tracey Hall
Researcher
082 563 5116
tracey.h1@iburst.co.za

Dr. Charmaine Gordon
Research supervisor
(011) 717-4527
charmaine.gordon@wits.ac.za

Appendix B: Consent form

In order to participate in this study on perceptions and willingness to incorporate technologies, it is necessary that you give consent.

By signing this consent form you are indicating that you have read and understood the information sheet attached and that you are agreeing to participate in psychological research.

Please consider the following points before signing:

- I understand that my participation will be anonymous and that all information I provide will remain confidential.
- I understand that the results may include the direct quotes from participants' answers, but that this will be completely anonymous.
- I understand that participation in research is not required, is voluntary, and that, after the research project has begun, I may refuse to participate further without penalty.
- I understand that I may contact the researcher (Tracey) at 082-563-5116 should I have any questions or comments about the research.
- I understand that there are no risks or benefits attached to my participation in this research.

I hereby consent to participate in research conducted on (date) _____by Tracey Hall.

_____

Participant signature

Appendix C: Self-Administered Questionnaire

QUESTIONNAIRE ON PERCEPTIONS OF AND WILLINGNESS TO INCORPORATE TECHNOLOGIES, SUCH AS NEUROFEEDBACK AND QUANTITATIVE ELECTROENCEPHALOGRAMS (qEEG's), INTO EVERYDAY PRACTICE

SECTION 1: BIOGRAPHICAL INFORMATION

In the following sections, please mark the appropriate box with an x.

1. Please indicate whether you are:

Male	
Female	

2. How old are you?

20-25	
26-29	
30-34	
35-39	
40-49	
50-59	
60+	

3. What race are you?

African	
Indian	
White	
Asian	
Other	

4. Where do you work?

Private practice	
School	
Institution	
Other (Please specify)	

5. Please indicate which category you are registered as:

Clinical Psychologist	
Counselling Psychologist	
Educational Psychologist	
Other (Please specify)	

6. How many years have you been practicing for?
_____

7. What qualifications do you have?
_____
_____

8. What are some of the common presenting problems clients come to you with?
_____
_____
_____

SECTION 2: PERCEPTIONS AND WILLINGNESS TO INCORPORATE TECHNOLOGIES, SUCH AS NEUROFEEDBACK AND QEEG'S, INTO EVERYDAY PRACTICE:

1. What is your understanding of the following technologies:
EEG Neurofeedback:_____
_____
_____
Quantitative electroencephalogram (qEEG):_____
_____
_____

2. Do you feel that these particular technologies would be useful to the field of educational psychology? Elaborate. Please use specific examples.

3. What do you perceive to be the possible benefits of incorporating these technologies into your practice?

4 Please describe any concerns that you may have regarding the incorporation of these technologies into your practice?

5. Are you willing to incorporate these technologies into your everyday practice? Which ones? Why?

6. Have any of these technologies assisted you in your dealings with clients? How?

7. What do you think you will need to make it easier to incorporate these technologies into your everyday practice?

8. What are your sentiments regarding receiving further education and training in these technologies?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

9. Further comments or suggestions

_____
_____
_____
_____
_____
_____
_____

Thank you for your time in completing this questionnaire!!

Appendix D: Letter of permission from site

Psychology
School of Human & Community Development
Private Bag 3, Wits 2050, South Africa. Telephone: +27 11-717-4500/2/3/4. Fax: +27-11-717-4559

86 3rd Avenue
Westdene
2092
South Africa

Dear Dr. Marita Brink

My name is Tracey Hall, and I am conducting research in partial fulfulment obtaining a Masters degree at the University of the Witwatersrand. My research focuses on **psychologists' perceptions of and readiness to incorporate technologies, such as EEG Neurofeedback and Quantitative Electroencephalograms (qEEG), into everyday practice.** This study aims to gain an understanding of psychologist's perceptions and willingness to incorporate these technologies as well as to explore any suggestions they may have which they perceive will make the incorporation of these technologies easier. Neurofeedback is a training procedure designed to enhance efficacy of brain function. It is a form of biofeedback that utilizes EEG technology to monitor brain activity. Electrodes are placed on the scalp and the EEG signal is processed and presented to the client in the form of a simple video game. Quantitative Electroencephalography (qEEG) is the measurement, using digital technology, of electrical patterns at the surface of the scalp which primarily reflect cortical activity or "brainwaves". A multi-electrode recording of brain wave activity is recorded and converted into numbers by a computer. These numbers are then statistically analysed and are converted into a colour map of brain functioning. The questionnaire (see attatched) asks for the opinions of psychologists regarding the incorporation of these technologies into their practice.

I will require 50 Educational psychologists to complete a questionnaire on their perceptions and willingness to incorporate these technologies. Would it be possible for me to hand out the questionnaires to psychologists attending one of your seminars?

The questionnaire will take approximately 10 minutes to complete. Participation is voluntary, and participants will not be advantaged or disadvantaged in any way for choosing to complete or not complete the questionnaire. No identifying information will be asked for and participants may remain anonymous.

If you do choose to allow me access to your seminar to distribute the questionnaires, please complete the letter below and fax it to me at (011) 886-8892

Kind Regards

Tracey Hall
Researcher
082 563 5116
tracey.h1@iburst.co.za

Dr. Charmaine Gordon
Research supervisor
(011) 717-4527
charmaine.gordon@wits.ac.za

Permission to hand out questionnaires at training seminar:

I_____hereby grant permission for Tracey Hall to hand out her questionnaires to psychologists at my training seminar for her study on "Educational psychologist's perceptions and willingness to incorporate technologies, such as EEG Neurofeedback and Quantitative Electroencephalograms (qEEG's), into their everyday practices".

Signed: _____

Date: _____

Appendix E: Ethical Clearance Certificate

Faculty of Humanities - Postgraduate

Private Bag 3, Wits 2050, South Africa • Tel: +27 11 717 4002 • Fax: +27 11 717 4037 • E-mail: Julie.Poyser@wits.ac.za

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Student Number: 0711290M

Ms T Hall
P O Box 906
Bromhof
2154

02 June 2009

Dear Ms Hall

APPROVAL OF PROPOSAL FOR THE DEGREE OF MASTER OF EDUCATION IN EDUCATIONAL PSYCHOLOGY

I am pleased to be able to advise you that the readers of the Graduate Studies Committee have approved your proposal entitled *""Educational psychologists' perception of and readiness to incorporate brain technologies, such as EEG Neurofeedback, and quantitative Electroencephalogram into their everyday practices"* and you have now been admitted to full candidature. I confirm that Dr C Gordon has been appointed your supervisor in the Discipline of Psychology.

The research report is normally submitted to the Faculty Office by 15 February, if you have started the beginning of the year, and for mid-year the deadline is 15 August. All students are required to RE-REGISTER at the beginning of each year.

You are required to submit 2 bound copies and 1 CD in pdf (Adobe) format of your research report to the Faculty Office. The 2 bound copies go to the examiners and are retained by them and the 2 corrected unbound copies are eventually sent to Archives and to the Library.

Please note that should you miss the deadline of 15 February you will be required to submit an application for extension of time and register for the research report extension. Any candidate who misses the deadline of 15 February will be charged full fees for the year.

I should be glad if you keep us informed of any changes of address during the year.

Note: All MA and PhD candidates who intend graduating shortly must meet your ETD requirements at least 6 weeks after your supervisor has received the examiners reports. **Students must remain registered at the Faculty Office until graduation.**

Yours sincerely

Nadia Mohamed (Ms)
Postgraduate Division