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Received 05/02/10
Revised 02/08/11
Accepted 03/20/11

Brain Wave Biofeedback: Benefits of Integrating Neurofeedback in Counseling

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Consistent with the *2009 Standards* of the Council for Accreditation of Counseling and Related Educational Programs, counselors must understand neurobiological behavior in individuals of all developmental levels. This requires understanding the brain and strategies for applying neurobiological concepts in counseling practice, training, and research. Neurofeedback, biofeedback for the brain, is one modality based in neuroscience that empowers individuals to recognize, monitor, and self-regulate brain wave activity to create greater wellness. Neurofeedback has significant potential in counseling preparation, research, and practice.

Imagine a simple procedure versatile enough to treat epilepsy, autism, and attention deficit disorder, addictions, and depression without drugs, surgery, or side effects. These are only some of the capabilities of neurofeedback.
—Jim Robbins (2008, inside cover)

The Association for Applied Psychophysiology and Biofeedback (AAPB) and the International Society for Neurofeedback and Research (ISNR) defined biofeedback as "a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance" (AAPB, 2008, "What Is Biofeedback," para. 2). Biofeedback allows individuals to be actively involved in the control of their own physiological and emotional processes (i.e., self-regulate), first aided by equipment that measures physiological activity and later without the use of such instruments (Wheat & Larkin, 2010). Neurofeedback (NFB), a subset of biofeedback, allows clients to monitor and change their brain wave patterns, which leads to changes in behavior (Heinrich, Gevensleben, & Strehl, 2007). Recent meta-analyses and reviews of outcome research have established the effectiveness of NFB in improving the quality of life through symptom reduction for persons with attention-deficit/hyperactivity disorder (ADHD; Arns, de Ridder, Strehl, Breteler, & Coenen, 2009; Williams, 2010), autism spectrum disorder (Cohen, Linden, & Myers, 2010), Asperger's syndrome (L. Thompson, Thompson, & Reid, 2010), sexual behavior problems (Longo, 2010), drug addiction (Sokhadze, Stewart, & Hollifield, 2007), and epilepsy (Walker, 2010), among other conditions. In a recent position paper, Sherlin, Arns, Lubar, and Sokhadzke (2010) provided evidence to support the designation of NFB as a safe and efficacious treatment for ADHD, meeting the criteria for a Level 5 treatment system using the ISNR and AAPB five-level rating system (La Vaque et al., 2002).

NFB has been shown in multiple studies to improve autonomic regulation, promote brain competencies, help remediate brain-based functional disorders through both symptom reduction and the amelioration of underlying conditions, and enhance optimum performance (Arns et al., 2009; Vernon, 2005). NFB reduces the need for psychoactive medications and has been shown to be as effective as medications in the treatment of ADHD (Vernon, Frick, & Gruzelier, 2004). Experienced clinicians have reported that NFB has success rates of 60% to 80% (Evans & Rubi, 2009; Gunkleman & Johnstone, 2005) with virtually no side effects (S. Othmer, 2009). Relatedly, functional imaging studies using techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) have begun to demonstrate that counseling and psychotherapy actually change how the brain functions (Linden, 2006). On the basis of these findings, it is timely to consider how NFB, as well as neuroscience, can be integrated into counseling practice, preparation, and research.

The *2009 Standards* of the Council for Accreditation of Counseling and Related Educational Programs (CACREP) require all counselors to have curricular experiences to promote an understanding of the "nature and needs of persons at all developmental levels, . . . theories of learning and personality development, including current understandings about neurobiological behavior" (CACREP, 2009, p. 10). Neurobiological behavior is further defined as "the relationship among brain anatomy, function, biochemistry, and learning and behavior" (CACREP, 2009, p. 60). The intent of the *2009 Standards* clearly is not to add courses in neuroscience, neuroanatomy, or brain functioning to the knowledge base for counseling, but rather to help counselors integrate important concepts from neuroscience into counseling work (Ivey, Ivey, Zalaquett, & Quirk, 2009). We propose NFB as the foundation for this integration because it not only incorporates an understanding of neuroscience, the study of the brain and nervous system, but also offers an applied means of intervention that counselors can implement to promote and evaluate positive client change. Whereas other applications of neuroscience such as PET scans and fMRIs are commonly used in medical settings,

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NFB is a method that counselors can use in both academic settings and practice settings. We view NFB as among the most accessible and tangible applications of neuroscience that counselors might utilize for the neuroscience needs of the counseling field.

The evolving accreditation demands and practice realities of the profession make it incumbent on counselor educators to provide counselors-in-training with preparation in (a) the psychobiological basis of clinical behaviors encountered, (b) how to make diagnoses supported by biological measures, (c) skills in selecting treatments that affect client biology, and (d) the ability to justify interventions to interested parties. To this end, NFB training is consistent with the evolution of the overall helping field. The NFB approach fits naturally with counseling philosophy because of its noninvasive design for increasing functionality through empowering clients to strengthen core performance in a manner sustainable over time. Furthermore, NFB is consistent with counseling's wellness perspective (e.g., Myers & Sweeney, 2008), making biofeedback and NFB well suited for counselors-in-training to receive training in and to use in practice.

Regardless of the degree to which counselor training programs adopt NFB or similar modalities as a component of training, it is increasingly clear within the broader mental health field that great effort is currently under way to identify the neurobiological basis of mental health and disorders (e.g., Bora, Yucel, & Allen, 2009; Mendez, 2009). Commonly encountered issues such as ADHD, behavior problems, addiction, anxiety, and depression are of particular interest. In fact, the strategic plan of the National Institute of Mental Health (NIMH) indicates the ambitious intention to identify the biological causes of mental disorders, conditions that constitute the leading cause of disability in the United States. Currently, roughly one in 17 adults suffer from a seriously debilitating mental illness. To address this burden, NIMH (2010) identified four strategic objectives to guide research efforts over the next 5 years, the first of which is to "promote discovery in brain and behavioral sciences to fuel research on the causes of mental disorders" (p. 1). NIMH indicated that as researchers build

> on new discoveries from genetics, neuroscience, and behavioral science, we are better poised to understand how the brain, behavior, and the environment interact to lead to mental disorders. Mental illnesses are now studied as brain disorders, specifically as disorders of brain circuits. The current era of neuroscience promises to reveal much about their origins, development, and manifestations. In addition to translating neuroscience discoveries to the clinic, we are also in a phase of using clinical findings (e.g., genetic or brain imaging data) from those with mental disorders to guide research on neurobiology. (NIMH, 2010, p. 1)

Given that the research findings of NIMH and similar agencies will become the practice standards of the future, it is critical that counselors-in-training understand and can participate in the discourse relating to such research initiatives.

Our purpose in this article is to provide an overview of NFB, including the physiological processes involved in brain wave biofeedback, and clinical uses, including assessments and interventions. We first briefly describe the history of NFB to provide a context for the current state of both clinical applications and research in this area. Next, NFB assessments, interventions, possible side effects that have been reported in the literature, contraindications, and benefits of NFB are described. We review research support for NFB with various populations and discuss methodological limitations. Finally, strategies for integrating NFB into counseling practice, counselor education, and counseling research are explored.

History of Biofeedback and NFB in Counseling

S. Othmer, Pollock, and Miller (2005) identified two independent sets of historical events that led to the development of NFB, one highly scientific and the other arising from a search for altered states of consciousness. In the 1960s at the University of Chicago, Dr. Joe Kamiya found that low frequency alpha brain waves (described later in this article), which are associated with relaxation and meditation, were trainable; through positive reinforcement, desirable brain states could be achieved and maintained (Kamiya, 1969). Alpha wave training quickly became identified with the psychedelic movement. At about the same time, Dr. Barry Sterman, who was working at the University of California, Los Angeles School of Medicine, found that frequency waves higher than alpha, termed sensorimotor rhythm (12–15 cycles per second [cps]), were also trainable (see Sterman & Egner, 2006). Cats that experienced high frequency electroencephalographic (EEG) training were able to raise their seizure threshold and had greater tolerance for toxic substances. After training, cats exposed to rocket fuel survived, whereas cats that had not had EEG training were subject to seizure and died. EEG training or biofeedback based on this research was soon used with a variety of conditions, including ADHD, traumatic brain injury (TBI), sleep disorders, and depression.

Biofeedback was introduced in counseling in the late 1960s to teach self-regulation of physiological processes and as "a way of helping people learn to alter their states of consciousness, thereby promoting access to unconscious material" (Henschen, 1976, p. 327). Henschen described interventions to promote reverie (highs without drugs), such as slow wave alpha training, accompanied by pleasant feelings, and alpha–theta training (slow alpha waves combined with even slower theta waves), designed to help clients enter a meditative state, experience dissociation, and produce hypnagogic images of unconscious material. Early criticisms of biofeedback and EEG biofeedback included admonitions about associations with mind control and religious teach-

ings, especially in school settings (Kater, 1975). Counselors who introduce NFB today may find that similar associations and criticisms will be voiced, although new understandings from neuroscience and recent research in EEG biofeedback support the efficacy of NFB as a direct and positive means of influencing brain functioning.

Neuroscience, Brain Physiology, and NFB: Counseling and the Brain

Ivey et al. (2009) observed that "the bridge between biological and psychological processes is erasing the old distinctions between mind and body, between mind and brain" (p. 44). They cited five concepts that demonstrate how counseling can change the brain in positive ways. First, the brain is capable of changing and remodeling itself, according to the principle of neuroplasticity. Second, through neurogenesis, the brain is capable of building new neural pathways and new learning across the life span. Third, counseling skills such as attending are measurable with brain imaging; in addition, empathy can be physically identified and measured in patterns of brain activity. Fourth, each person's emotions fire in different parts of the brain; however, stress hormones (e.g., cortisol) have a pervasive, negative effect on overall brain functioning. Fifth, training the frontal cortex will promote strengths and wellness. These concepts are applied throughout the process of NFB and are based in brain physiology and brain wave activity.

The human brain is complex and includes multiple interdependent structures. A thorough knowledge of these structures, the methods of neuronal communication, and the influence of the endocrine or hormonal system on human thoughts, emotions, and behaviors form the foundation of neuroscience (Society for Neuroscience, 2010), which in turn is fundamental to understanding NFB. The interested reader is referred to texts written by authors such as Soutar and Longo (2010) for a greater understanding of brain components and functions and a review of the frequent, direct links between regional and localized brain functioning and psychological symptoms and dysfunction. Demos (2005) provided a clear description of the electrochemical activity of the brain and the manner in which specific brain structures (e.g., the hypothalamus, thalamus, cortex, neocortex) communicate, creating brain waves that are measurable through EEG.

The spectrum of EEG brain wave activity is divided into bandwidths reflective of specific wave lengths, shapes, amplitudes, and frequencies (Heinrich et al., 2007; Vernon, 2005). Delta waves (1–4 cps) are predominant during sleep. Theta waves (4–7 cps) occur when people are drowsy or daydreaming. Alpha waves (8–12 cps) represent the brain idling and ready for action. Beta waves (13–21 cps) are associated with thinking and focusing, or sustaining attention, whereas high beta waves (20–32 cps) are indicative of hyperactivity and anxiety. The sensorimotor rhythm (12–15 cps) is associated with mental alertness and physical relaxation. EEG assessments, termed quantitative EEG or QEEG, are used to determine whether brain wave patterns are normative, too fast or too slow, symmetrical or not (i.e., the same in each brain hemisphere, bilaterally and front to back), or clinically disturbed and reflective of possible abnormalities (Masterpasqua & Healey, 2003; Thornton & Carmody, 2008).

NFB Assessments, Interventions, Side Effects, and Contraindications

Assessment is critical to effective NFB and is a multimodal, multidimensional process (Coben & Padolsky, 2007; Hammond, 2010). It begins with an extensive clinical interview, psychological testing as appropriate to the needs of the client (e.g., Beck Depression Inventory, Test of Variables of Attention [TOVA]), psychosocial history, social/family support, and, for private practitioners, assessment of insurance and client ability to pay for sessions. During the initial interview, the client is educated about NFB, possible side effects are discussed, and contraindications to successful interventions are considered before the initiation of the QEEG.

QEEG Assessment: Brain Mapping

The QEEG, or brain map, is essential for treatment planning, although many practitioners begin NFB training without mapping, based on presenting symptoms (Hoffman, 2007). Hammond (2010) described the potential confounds to treatment planning in the absence of a QEEG and noted that the "QEEG provides reliable, non-invasive, scientifically objective, culture-free, and relatively low-cost evaluation of brain function" (p. 34). EEG measurements are taken at 19 sites based on an international 10–20 system for assigning letters and numbers to specific brain positions. A cap is placed over the client's head, conductive paste is applied to holes matched to the 19 sites, and electrodes or sensors are attached at the sites. Measurements of electrical activity of the brain at each site are recorded, first with the client's eyes open and then with the client's eyes closed. This procedure is not invasive because electrical currents are not applied to the brain but rather measured coming from the brain through the scalp.

The EEG information is edited to remove artifacts such as extraneous eye blinks or muscle movements, then entered into a computer database that generates reports that show averages for wave dominance, frequency, amplitude, and other measures. The potential for artifacts caused by muscle tension is evaluated, and a comparison is made between eyes open and eyes closed. The eyes-closed assessment tends to be most artifact-free and therefore most accurate; however, for training purposes, the eyes-open assessment is often the choice because it provides more feedback both for and from the client and thus enhances the training process and provides greater diagnostic utility. For example, in the treatment of persons with TBI, the eyes-open protocol will be much more

sensitive in diagnosing specific areas of dysfunction (Thornton & Carmody, 2008).

The final step in computer analyses of EEG data is the generation of a multicolored map showing the level of brain wave activity for each of the sites and *Z*-score deviations from norms for each site. Several QEEG normative databases have been developed to assist in interpretation of QEEG data. The assumption underlying these databases is that they represent "normal" brain functioning, thus ascribing meaning to *Z*-score analyses and interpretations of deviations from the norms or average for each site. The greater the *Z*-score deviation from zero, or average, the greater the chance that brain functioning at a particular site is abnormal. Abnormalities may reflect brain wave activity that is higher or lower than normal. Congedo and Lubar (2003) observed that parametric data from *Z* scores provides an accurate normative base if the sample size exceeds 100. They also suggested using nonparametric, percentile norms to reduce error potential. In reviewing the literature, we were unable to find evidence that this suggestion has been followed, and *Z*-score interpretations remain the basis of existing normative interpretations of QEEG data (Collura, 2010; Thatcher & Lubar, 2008).

Diagnosis and Differential Diagnosis

M. Thompson and Thompson (2007) noted that the EEG "acts like a 'flag' that reflects brain functioning. Just as you infer from a flag's activity the wind's velocity and direction, you make inferences about the brain's activity by reading the EEG" (p. 255). They also emphasized the need for a neurological assessment if abnormal waveforms are observed, stating that QEEG is done "to look at data concerning normal brain waves" (p. 257). EEG data are interpreted by comparing client data with normative databases; at that point possible diagnoses are considered. Although "QEEG cannot diagnose a particular condition or mental/physical health concern, . . . QEEG can in fact verify a particular diagnosis or verify the reported symptoms of a patient (differential diagnosis)" (Soutar & Longo, 2010, p. 73).

Hammond (2010) reviewed the research using QEEG and cautioned that there is great heterogeneity in EEG patterns associated with symptoms and diagnoses, noting that "similar symptoms may stem from widely divergent etiologies" (p. 32). Accurate diagnosis is complicated because of the prevalence of dual diagnosis for many if not most clients, creating multiple possible EEG patterns that may be related to specific symptoms. However, there is general agreement among practitioners and researchers that there are indeed specific EEG patterns corresponding to specific 10 to 20 scalp locations and underlying brain structures that are correlated with symptoms and symptom clusters, and which through NFB result in the amelioration of symptoms. Hence, QEEG is rapidly becoming essential for accurate clinical diagnosis (Hammond, 2010). For example, Thatcher, Walker, Gerson, and Geisler (1989) used QEEG to study clients with and without TBI and found that QEEG successfully discriminated TBI in 95.4% of cases.

Some wave forms have been strongly associated with certain behaviors and form the basis of typologies for diagnosis. For example, "too little alpha in the right hemisphere seems to correlate with . . . social withdrawal. Individuals with depression have this pattern. Too much beta on the right is highly correlated with mania" (Soutar & Longo, 2010, p. 70). High beta is found in many disorders, including obsessive-compulsive disorder, sleep disorders, ADHD, anxiety, depression, and learning disorders (Demos, 2005). Persons who abuse alcohol chronically have been found to have lower levels of alpha and theta waves and an excess of beta waves, perhaps contributing to use of alcohol to raise levels of those brain waves to a more pleasant state of relaxation (Peniston & Kulkowsky, 1989).

Beyond confirmation from experienced clinicians, numerous studies have been reported verifying common EEG patterns related to specific diagnoses. Hammond (2007) prepared a comprehensive bibliography of 354 published studies using NFB, organized by diagnostic category, which include much of what is known in this area. Heinrich et al. (2007) reviewed many of the same studies and concluded that several diagnostic patterns are supported in the literature. For example, children with ADHD show different patterns of QEEG based on subtypes of this diagnosis (i.e., inattentive, hyperactive-impulsive, or combined). Most have increased slow wave (theta) activity in the frontal and central regions of the brain and reduced alpha or beta waves reflecting underarousal of the central nervous system (Loo & Barkley, 2005).

NFB Interventions

NFB interventions are based on thorough, accurate assessments and are matched to the client's needs. Training may occur at one site or multiple sites and may involve encouraging/uptraining of an abnormally low brain wave frequency or inhibiting/downtraining of an abnormally high brain wave frequency. Training may be done with eyes closed, in which case the client is taught to listen for sounds that occur after a particular brain wave threshold is reached, or it may be done with eyes open, in which case the client may view a computer game for which immediate feedback results from changes on the screen when preset brain wave thresholds are achieved. In the eyes-open condition, clients may sit watching a screen and observing a rocket ship move along a brightly lit tunnel, following twists and turns as it motors along. The more the client focuses, the more quickly the rocket moves along its path; when the client does not focus, the ship may stop moving altogether and the screen may dim. On the basis of the parameters the NFB practitioner sets for the activities, particular brain wave patterns are reinforced so that when the client's brain is operating within the desired guidelines, the rocket moves forward easily.

All protocols "exemplify reward-based training: that is, the trainee receives a cue in the form of auditory or visual

feedback designed to encourage EEG activity within a desired band" (S. F. Othmer & Othmer, 2009, p. 111). EEG training is especially useful with children and adolescents as they respond positively to the eyes-open condition using computer graphics and games that are adjuncts to training. The number of sessions required to achieve desired effects varies between 20 and 60. Although clients may experience immediate perceptions of change, permanent change requires extended treatments. As clients learn to recognize new brain wave patterns through feedback and reinforcement, they can generalize this learning in daily life.

Johnson and Bodenhamer-Davis (2009) studied agreement on NFB protocols among 13 practitioners who had been in the field between 5 and 20 years. The researchers sent each practitioner a case study with presenting problems listed and QEEG data provided. Respondents agreed completely on

> treating the frontal lobe though specific site recommendations varied . . . the majority . . . were in agreement as to which brain wave frequency bandwidths to train, though sites varied . . . and there were also slight discrepancies as to whether to inhibit or reinforce the agreed-upon bandwidth frequency. (Johnson & Bodenhamer-Davis, 2009, p. 54)

Possible Side Effects and Contraindications to Treatment

Most clinicians report that NFB has minimal to no immediate side effects, as well as no enduring side effects; however, a few caveats have been reported. The brain, like any muscle, responds to exercise in a gentle, systematic, growth manner when not overworked (Soutar & Longo, 2010). Successful NFB interventions require client cooperation and motivation and may be sabotaged by events such as illness or personal crisis or trauma, inadequate sleep, poor nutrition, or excessive consumption of sugar or caffeine. Clients with personality disorders and those unable to disengage from stressful thoughts may not be ready for NFB. Hammond (2010) cautioned practitioners about the importance of both accurate assessment and individualizing NFB to avoid iatrogenic effects of treatment. Possible transient side effects reported in his review included increased irritability, anger, and depression, as well as somatic symptoms such as headaches, sleep disturbance, and fatigue.

Alpha–theta training is a commonly used protocol in which both alpha waves and theta waves are rewarded, with a goal of facilitating the transition from theta (going to sleep) and alpha (staying relaxed and awake) phases. During these transition or crossover periods, clients may experience hypnagogic imagery (e.g., internal pictures and sounds) accompanied by deep personal insights or, of greater concern, the reexperiencing of trauma. They also may be highly suggestible and open to influence. White and Richards (2009) referred to alpha waves as "a bridge from the external world to the internal and vice versa" (p. 149), noting that the "inner healer" is often encountered in this process. Some of the earliest evidence in support of the efficacy of NFB came from random assignment of people with chronic alcohol abuse to groups in which they received either alpha theta training or more traditional interventions. Peniston and Kulkowsy (1989) reported that virtually all participants in the NFB group remained abstinent after 13 months, whereas eight of 10 participants in the control group relapsed. This research has been replicated (Saxby & Peniston, 1995) as part of the growing body of support for NFB interventions.

Research Support for NFB

Comprehensive reviews and studies using QEEG and NFB are included in a special issue of the *Journal of Neurotherapy* (2008, Vol. 12) and at the ISNR website (http://www.isnr.org/ComprehensiveBibliography.cfm). Our review revealed over 250 studies in the past 7 years alone, with results that are promising yet not definitive. Evans and Rubi (2009) observed that no medications have ever approached the 35% to 40% effectiveness rate of placebos, yet NFB practitioners consistently report success rates that are double those figures (70% to 80%). NFB seems to be effective, not as a stand-alone procedure but rather when combined with cognitive strategies and other forms of biofeedback for both psychopathology and physical and developmental disorders, as well as for educational and performance enhancement (Gunkleman & Johnstone, 2005; Sterman & Egner, 2006; Thornton & Carmody, 2008; Vernon, 2005).

Masterpasqua and Healey (2003) examined reviews of more than 200 studies and determined that QEEG assessment is useful for a wide range of clinical conditions, including "cerebrovascular disease, dementia, learning and attention disorders, mood disorders, post-concussion syndrome, schizophrenia, and substance abuse" (p. 653). Multiple studies have provided support for the efficacy of NFB in treating ADHD and disorders in the autism spectrum (Toplak, Connors, Shuster, Knezevic, & Parks, 2008), addictions (Sokhadze, Cannon, & Trudeau, 2008), and epilepsy (Sterman & Egner, 2006). Numerous other disorders have been treated with varying degrees of success, including closed head injury or TBI, bulimia, chronic pain, PTSD, sleep disorders, impulsivity, social phobia, depression, anxiety, abuse and neglect, diabetes, fibromyalgia, Down syndrome, reading disability, juvenile offender issues, pervasive developmental disorder, premenstrual syndrome, cerebral palsy, cocaine addiction, and cognitive decline/dementia, balance, and incontinence among frail older adults (Hammond, 2006; Tinius, 2007).

Vernon (2005) reviewed existing research and observed that educationally, NFB training may enhance performance of normal individuals in three areas: sports, cognitive performance, and artistic performance. Bloom, Benjamin, Parkinson, and Gruzelier (2009) reported significant improvement in microsurgical technique following NFB training while

reducing task time by 26%. NFB has been shown to increase attentional abilities; promote physical and psychological well-being (Gruzelier & Enger, 2005); and enhance response control, mood, emotional intelligence, and self-efficacy (Friston, Wadkins, Gerdes, & Hof, 2007).

Despite these studies' outcomes, the efficacy of NFB remains in question, in part because of methodological limitations of existing studies and the lack of sufficient studies using randomized, controlled clinical trials. Although using placebos in NFB is difficult and may simply be impossible for practitioners as well as clients because both would soon know if a treatment was in fact "real," the assessment of treatment efficacy remains an imperative (La Vaque et al., 2002). La Vaque et al. (2002), following a charge from a joint committee of the AAPB and ISNR, presented a template for evaluating the clinical efficacy of psychophysiological interventions. They identified a hierarchy of evidence, beginning with anecdotal evidence and uncontrolled case studies and extending through double-blind controlled studies and treatment superiority studies. The authors provided recommendations for evaluating studies based on a variety of factors, including the ability to replicate findings consistently across clinical settings.

Several reviews and meta-analyses using components of La Vaque et al.'s (2002) template offer promising outcomes of studies with a variety of populations, including ADHD (Arns et al., 2009), autism spectrum disorder (Cohen et al., 2010), Asperger's syndrome (L. Thompson et al., 2010), and substance use disorders (Sokhadze et al., 2007). From our review of these studies, we believe that NFB has a sufficient scientific basis for integration in counseling practice and offers a variety of advantages over other possible assessments and interventions arising from the growing body of knowledge in neuroscience.

For example, Arns et al. (2009) conducted a meta-analysis of prospective controlled studies and studies using pretest–posttest designs, reported in the journal *Clinical EEG and Neuroscience*, and found large effect sizes (ES) for NFB in reduction of impulsivity and inattention among children diagnosed with ADHD. Medium effects were found for hyperactivity. Their conclusions were noteworthy:

> Due to the inclusion of some very recent and sound methodological studies in this meta-analysis, potential confounding factors such as small studies, lack of randomization in previous studies and a lack of adequate control groups have been addressed, and the clinical effects of neurofeedback in the treatment of ADHD can be regarded as clinically meaningful. . . . [In] line with the AAPB and ISNR guidelines for rating clinical efficacy, we conclude that neurofeedback treatment for ADHD can be considered "Efficacious and Specific" (Level 5) with a large ES for inattention and impulsivity and a medium ES for hyperactivity. (Arns et al., 2009, p. 180)

Integrating NFB Into Counseling Practice, Preparation, and Research

Crane (2009) estimated that there are between 10,000 and 20,000 NFB practitioners in the United States and half that number in other countries, although it is currently unclear how many of those are trained counselors. Voluntary national certification is available through the Biofeedback Certification Institute of America (BCIA; http://www.bcia.org/). In addition to a basic course in neuroanatomy, or anatomy and physiology, BCIA requires 36 hours of didactic instruction in the history of NFB, learning theory and principles, neuroanatomy, instrumentation, diagnosis and treatment protocols, and ethics. Mentoring during academic (10 hours) or clinical practice (25 hours) is required depending on the level of certification desired (i.e., academic or clinical).

Few, if any, states currently legislate NFB practice, and obtaining third-party payments is difficult. Practitioners wishing to add NFB as a specialty are encouraged to read foundational texts such as Demos's (2005) comprehensive book, *Getting Started With Neurofeedback,* and Budzynski, Budzynski, Evans, and Abarbanel's (2009) *Introduction to Quantitative EEG and Neurofeedback.* Writing from the perspective of a licensed mental health counselor, Demos provided an overview of brain physiology, QEEG, and NFB. He described the requirements for NFB certification, ethical practice, and expenses involved in obtaining training, supervision and mentoring, and certification. He estimated the costs of training to be at least $5,000 and cautioned practitioners to research equipment carefully prior to making purchases and to expect an investment of $3,000 to $10,000 for a data acquisition/NFB training system. This is a substantial investment; however, it is far less costly than fMRIs and PET scan equipment, both of which require professional preparation beyond the requirements of counselor training.

An even less costly alternative involves the use of audiovisual entrainment (AVE), a form of NFB based on research related to photic stimulation that can result in both transient and lasting changes in brain wave activity (Collura & Siever, 2009). AVE "uses flashes of lights and pulses of tones to gently and safely guide the brain into various brain wave patterns to boost your mood, help with sleep, sharpen your mind and increase your level of relaxation" (Mindalive.com, 2011). AVE equipment can be purchased for less than $300 and can be a useful adjunct to counseling. For example, clients could engage in 20 to 30 minutes of AVE prior to the start of a session as a means of disengaging from stressful life events and achieving a state of relaxation, thus enhancing their ability to quickly focus on issues of emotional importance. Counselors might also use AVE after particularly difficult sessions to restore a sense of calm in preparation for seeing additional clients in their workday. Counseling students might use AVE as a means of relaxation before difficult exams.

Although it might be beyond the capacity of all counselor training programs to purchase and train faculty members in the use of NFB, perhaps with the exception of AVE, it is well worth considering how these methodologies might be integrated into the clinical paradigm of training curricula. Ideally, counselor education programs would purchase NFB equipment and train faculty and students in its use. However, if this is impractical, identifying a clinical faculty member within the university or surrounding area who has been trained in NFB would allow faculty members to draw on the expertise of such an individual when teaching neuroscience material. Furthermore, demonstrations of NFB by a trained practitioner often convince students of the potential for this modality. Clinical faculty members with this expertise provide yet another possibility for some counseling programs.

The field of counseling needs research demonstrating the efficacy of the work of counselors (Sexton, 1996). Increasingly, the cultural currency within the mental health field is biological evidence of treatment effectiveness. In fact, most research funded by the National Institutes of Health and the NIMH requires testing of interventions by means of sophisticated neurological imagery (e.g., PET scans, fMRIs). For the counseling field to remain viable and contribute meaningfully to the evolution of psychological interventions, the field must begin to include brain-based measures in research and practice. NFB offers a relatively inexpensive method that can be integrated into counseling practice, preparation, and research to enhance the scientific basis of the field. Counselors can build on comprehensive literature reviews using NFB with various conditions to begin to explore the efficacy of NFB in their clinical practice.

The QEEG assessment described earlier offers a concrete mechanism beyond the clinical interview for verifying suspected disorders counselors encounter in practice. In research, QEEG offers a potential avenue to assess clinical disorders and reassess after interventions to demonstrate change. A totally unexplored area in NFB research is the relationship between wellness and brain functioning. Counselors operating from a preventive, developmental, wellness-based paradigm may find NFB a useful approach to support the need for both general and specific wellness interventions.

There is growing evidence to support the idea that psychotherapy is, in fact, a biological intervention. For example, Roffman, Marci, Glick, Dougherty, and Rauch (2005) reviewed 14 existing investigations that utilized brain imaging to determine the neurological impact of psychotherapeutic interventions. Their findings indicated that "behavioral therapy for anxiety was consistently associated with attenuation of the brain-imaging abnormalities in regions linked to the pathophysiology of anxiety, and with activation of regions related to positive reappraisal of anxiogenic stimuli" and that cognitive behavioral therapy and interpersonal therapy were "associated with markedly similar changes in the cortical-subcortical circuitry" (Roffman et al., 2005, p. 1385). Similarly, the work of Schwartz (1997), which is used in academic treatment centers throughout the world, demonstrates that behavioral interventions are as effective as medications for slowing the overactive portions of the brain among individuals with obsessive-compulsive disorder as seen on PET scans. Unfortunately, counseling researchers have largely failed to used brain-based measures to substantiate their work. NFB is a possible first step to attend to this oversight.

An exciting potential use of NFB is to provide outcome data for counseling interventions. Researchers have often faced the conundrum that many theories by their nature are difficult to prove or disprove. Yet, the demand for research that validates or refutes the efficacy of various psychotherapeutic interventions is clear. Insurance companies, Medicaid, Medicare, and other payers value evidence-based interventions and are moving increasingly toward reimbursing only for such treatments. Therefore, a service counseling researchers can provide the field is to substantiate the impact of counseling interventions by means of measures such as QEEG brain maps. A first step in this direction would be a large-scale survey of counseling researchers to determine what, if any, brain-based research methods are currently used. Such an effort would catalog current research approaches and facilitate dialogue regarding biological methodologies to investigate counseling interventions and outcomes.

Conclusion

As the demand grows for evidence of the effectiveness of counseling services, the need to clearly link counseling interventions and client change has never been greater. NFB offers the practicing counselor a powerful tool for the diagnosis and treatment of a variety of clinical issues and is a modality consistent with the developmental, strength-based precepts that underlie the field of counseling. Furthermore, NFB has the potential to provide counseling researchers a unique opportunity to investigate clinical interventions, providing biological evidence of their efficacy. Although readers likely have the clinical experience convincing them that their work changes lives, the viability of the field requires research to confirm that counseling is indeed worthy of the time and resource allocation it demands.

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Brain Wave Biofeedback: Benefits of Integrating Neurofeedback in Counseling
(*JCD*, Volume 90, Number 1, January 2012)

Learning Objectives

Reading this professional article will help you:

1. Examine the role that neurofeedback (NFB), including the physiological processes involved in brain wave biofeedback, can play in counseling.
2. Study the history of biofeedback and provide a context for the current state of both clinical applications and research in this area.

Examination Questions

1. Estimates suggest how many American adults suffer from a seriously debilitating mental illness?
   - ☐ a. 1 in 5
   - ☐ b. 1 in 12
   - ☐ c. 1 in 17
   - ☐ d. 1 in 25
2. When was biofeedback introduced in counseling?
   - ☐ a. 1920s
   - ☐ b. 1940s
   - ☐ c. 1960s
   - ☐ d. Beginning of this millennium
3. What assessment do the authors believe has the potential to allow counselors to assess clinical disorders and reassess after interventions?
   - ☐ a. QEEG or brain map
   - ☐ b. EEG
   - ☐ c. Beck Depression Inventory
   - ☐ d. Test of Variables of Attention (TOVA)

Date: _____

Signature: _____

Learning Assessments

On the basis of my reading of this article, I am able to:

1. Consider various strategies for integrating NFB into counseling practice, counselor education, and counseling research.

Strongly Agree		*Agree*		*Strongly Disagree*
5	4	3	2	1

2. Assess the potential contributions of NFB in counseling and psychotherapy.

Strongly Agree		*Agree*		*Strongly Disagree*
5	4	3	2	1

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