The Biofeedback Certification International Alliance

Blueprint of Knowledge Statements for Board Certification in Neurofeedback

The provider certified in Neurofeedback will have knowledge of:

I. Orientation to Neurofeedback – 4 hours

A. Definition of Neurofeedback (EEG Biofeedback)
Neurofeedback is employed to modify the electrical activity of the CNS including EEG, event related potentials, slow cortical potentials and other electrical activity either of subcortical or cortical origin. Neurofeedback is a specialized application of biofeedback of brainwave data in an operant conditioning paradigm. The method is used to treat clinical conditions as well as to enhance performance.

B. History and Development of Neurofeedback
1. Pioneers in EEG and Neurofeedback (e.g., Caton, Berger, Adrian, Kamiya, others)
2. Discuss highlights of the seminal studies in Neurofeedback (e.g., Sterman 1968, 2000, Lubar 1976, Birbaumer 1982, others)

C. Overview of principles of human learning as they apply to neurofeedback
1. Learning theory (e.g. habituation, classical and operant conditioning, discrimination, shaping, generalization and extinction.)
2. Application of learning principles to Neurofeedback (e.g., generalization to the life situation, discrimination training, length and number of sessions, etc.)

D. Assumptions underlying Neurofeedback:
1. Concepts of feedback and control in biological systems.
2. Basic psychophysiology of stress and attention

II. Basic Neurophysiology & Neuroanatomy - 4 hours

A. Neurophysiology
1. Bioelectric origin and functional correlates of EEG (pyramidal cell and dipole activity, resonance and synchrony, etc.)
2. Definition of ERPs and SCPs.
3. Relationship of post-synaptic potentials and action potentials to EEG
4. Neuroplasticity (e.g. LTD, LTP)

B. Functional Neuroanatomy
1. Basic neuroanatomy of ascending sensory pathways to cortex
2. Thalamic, cortical, and subcortical generators of EEG.
3. General cortical and subcortical anatomy.
4. Major functions of cortical lobes and major subcortical structures and Brodmann areas.
5. Overview of connectivity, phase, and coherence concepts related to EEG networks and tracts (e.g. default network, nodes & modules.)

III. Instrumentation & Electronics – 4 hours

A. Essential Terms & Concepts
Basic metrics and terminology in electronics and instrumentation such as, impedance, differential amplifier principles, analog and digital filters, basic electrical terms (e.g. AC, DC, sine waves, volume conduction, Nyquist principle, gain, Fourier transform, low/high bandpass and notch filters, etc.), and common mode rejection

B. Signal Acquisition
1. 10-20 International Standard measurement and nomenclature for 19 recording sites, both classical and modified
2. Comparison of QEEG to other neuroimaging techniques (e.g. PET, fMRI, CT, MEG, SPECT, etc.)
3. Use of limited number of electrodes (fewer than 19).
4. Montage options and their characteristics
5. Recognizing and correcting signals of noncerebral origin, such as but not limited to:
   a. Electromyographic
   b. Electro-ocular
   c. Cardiac (pulse)
   d. Sweat (skin impedance)
   e. Cable sway
   f. 60 Hz (grounding)
   g. Electrode “pop”
6. Recognizing normal EEG patterns
   a. posterior dominant rhythm

b. difference between eyes open and eyes closed resting conditions (e.g. posterior alpha attenuation)
c. developmental aspects of EEG
d. diurnal influences on EEG

7. Evaluation of subject variables during acquisition
   a. alertness-drowsiness
   b. medication/drug/alcohol effects
   c. physical relaxation
   d. eyes closed/eyes open/anxiety

C. Signal Processing
1. Analog, raw EEG
2. Basic signal measurement terms (e.g. amplitude, magnitude, power, Hz)
3. Filtering methods and subjective characteristics of frequency bands (delta, theta, alpha, beta, gamma)
4. Waveform morphology
5. Source localization (LORETA inverse solution, Laplacian analysis)
6. Clinically significant raw EEG waveforms (e.g. Mu, spike & wave, SMR, sleep spindles, etc.)

D. Aseptic Techniques
1. Client and trainer hygiene
2. Equipment sterilization
3. Cross contamination

E. Instrumentation Demonstration
Client preparation, basic set-up and operation of EEG equipment, proper electrode attachment and location of 10-20 sites, elimination of artifact from EEG recording, recognition of spike/wave activity in the raw EEG, etc.

IV. Research Evidence Base for Neurofeedback – 2 hours

A. Interpretation of the methodological and statistical criteria and procedures for determining levels of efficacy and effectiveness of neurofeedback, as outlined in the *Template for Developing Guidelines for the Evaluation of Clinical Efficacy of Psychophysiological Interventions and Evidence- Based Practice in Biofeedback & Neurofeedback.*

B. Key research studies establishing current efficacy levels of major applications of Neurofeedback (e.g., ADHD, Substance Abuse, Optimal Performance, etc.)

V. Psychopharmacological Considerations – 2 hours

A. Potential effects of prescribed and non-prescribed drugs on clinical presentation.

B. Potential effects of prescribed and non-prescribed drugs on EEG measures.

C. Potential effects of different drugs on neurofeedback assessment and training

VI. Patient/Client Assessment - 4 hours

A. Intake Assessment
1. The client's presenting symptoms and goals, medical and psychological conditions, medications, psychosocial and family history, and relevant biographical information, etc.
2. Pre and post-treatment assessments such as neuropsychological tests, continuous performance tests, EEG/QEEG, appropriate to your practice and licensure.

B. EEG Assessment
1. Standardized EEG Assessments (1 or 2-channel baselines)
2. Overview of QEEG – 19-channel QEEG or an abbreviated Q
   a. Reading topographical displays (brain maps) and connectivity/coherence displays
   b. Normative Databases
      - definition
      - common properties
      - how they are used
3. Recognizing common normal and abnormal patterns in the EEG (e.g., posterior alpha blocking with eyes open; excessive high frequency beta in alcoholism and anxiety; high frontocentral theta to beta ratio in ADHD, etc.)

C. Ongoing Assessment
1. Methods of periodic objective evaluation of patient/client progress
2. Adjusting and evaluating treatment procedures to improve outcome

D. Assessment Demonstration
Perform a basic EEG assessment, an abbreviated Q recording and/or attaching electrode cap and completing an abbreviated Q or 19-channel QEEG recording

VII. Developing Treatment Protocols – 6 hours

A. Evolution of neurofeedback protocols
Early protocols based on published studies (e.g.,Peniston Protocol and revised Peniston Protocols for alcoholism/PTSD, Theta/Beta protocol for ADHD, SMR protocol for epilepsy, etc.)
1. Protocols based on results of EEG analysis and psychometric assessments
2. Selecting a treatment model: standard (researched) protocols, QEEG-based amplitude and coherence/connectivity training, z-score training, LORETA z-score training, source localization training, SCP methods, etc.

B. Steps in protocol development and treatment planning using one or more of the treatment models

C. Demonstration and case example exercises for practice using steps/decision tree for applying client assessment data to neurofeedback protocol selection and treatment/training planning

VIII. Treatment Implementation – 6 hours

A. Client preparation for neurofeedback (e.g., orientation to neurofeedback and procedures; pre-training methods – respiration training, relaxation methods such as progressive relaxation, autogenic suggestions, HRV biofeedback, etc.)

B. Therapeutic relationship, coaching, and reinforcement strategies

C. Procedures and mechanics of conducting a neurofeedback session

1. Monitoring client reaction to treatment (e.g., use of pre-session questionnaires, etc.)
2. Obtaining clean EEG data (e.g., proper electrode attachment, impedance, artifact elimination, etc.)
3. Selecting appropriate electrode montages
4. Setting thresholds for amplitude training
5. Monitoring client progress (e.g., identifying drowsiness, revising protocols and moving to new sites, medication issues, identifying contraindications to treatment and adverse reactions, reading/interpreting session reports/graphs, etc.)

D. Introduction to Alpha-Theta Training
1. Applications (e.g., to over arousal conditions: anxiety, alcoholism, PTSD, etc.)
2. Indicators for using revised or original Peniston Protocol
3. Issues related to alpha-theta crossovers, emotional abreactions, etc.
4. Psychotherapeutic skills and additional training beyond Introductory level course required for Alpha-Theta practitioners

E. Guidelines and Cautions for Remote Training – refer to the ISNR Guidelines

F. Full Neurofeedback Session Demonstrations.

IX. Current Trends in Neurofeedback – 2 hours

A. Identify current trends such as z-score training, LORETA z-Score training, etc.

B. Combining neurofeedback with other modalities (e.g., HRV, respiration, HEG, neuromodulation systems, etc.)

1. Describe respiratory anatomy and physiology, including the muscles used in inhalation and exhalation
2. Explain the physiological mechanisms that generate end-tidal CO2 and regulate oxygen distribution to tissues
   a. Explain the importance of pH in respiratory physiology
   b. Explain the importance of the Bohr effect
   c. Recognize healthy end-tidal CO2 and oxygen saturation values.
3. Describe the following breathing patterns:
   a. Effortless breathing
   b. Over-breathing and hyperventilation
   c. Clavicular breathing
   d. Thoracic breathing
   e. Reverse breathing
4. Describe the effects of over-breathing on the EEG

X. Ethical & Professional Conduct – 2 hours

A. Ethical and Legal Practice
Familiarity with the BCIA Certification Guidelines, Professional Standards and Ethical Principles of Biofeedback, ISNR Practice Guidelines for Neurofeedback and ISNR Code of Ethics, and the practice guidelines of one's primary profession

1. Experimental vs. commonly accepted neurofeedback treatment
2. Advertising, marketing of services, and public statements
3. Continuing education and training

B. Clinical Practice

When treating a medical or psychological disorder, one is required to carry a valid state-issued health care license from a BCIA-approved health care field or agree to work under supervision.

C. Scope of Practice

Neurofeedback services should be limited to the practice standards and guidelines of one's license or the license of their supervisor and also to those areas where one has:

1. Sufficient training (e.g., alpha/theta)
2. Familiarity with the client population and disorders (e.g., age, diagnosis, etc.)

D. Client rights

1. Privacy, confidentiality, and privileged communication
2. Informed consent to assessment and treatment, treatment contract apprising of possible adverse effects
3. Accepting clients, abandonment, and appropriate referral
4. Equal access to health care
5. HIPAA compliance

E. Supervision

1. Appropriate consultation and supervision in neurofeedback;
2. Purposes and process of supervision and consultation
3. Purposes and process of mentoring.

F. Professional relationships

1. Dual relationships
2. Conflicts of interest and exploitation of clients
3. Consultation, referral, and relationships with other professionals
4. Medical and medication monitoring
5. Procedures for dealing with unethical behavior and consumer complaints

Total: 36 hours

2004 Revision prepared by the EEG Specialty Certification committee and adopted by the BCIA Board of Directors.

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