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PRACTICE

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Understanding and integrating neuroscience research into clinical practice represents a rapidly growing area in mental health. An expanding body of neuroscience literature increasingly informs clinical practice by validating theory, guiding clinical assessment and conceptualization, directing effective interventions, and facilitating cross-disciplinary communication. Little attention, however, has been given to the use of neuroeducation with clients. In this article, the author provides mental health counselors with a definition of neuroeducation and a rationale for incorporating neuroeducation into clinical practice. The author identifies common neuroeducation topics and offers activity suggestions to illustrate their use in counseling. Finally, the author offers best practices for implementing neuroeducation, including attention to counselor competence, client readiness, and neuroscience of learning principles. Implications for research are also discussed.

Over the last five years, the counseling field has experienced a surge in neuroscience-related interest. New counselor-oriented neuroscience textbooks (Badenoch, 2008; Chapin & Russell-Chapin, 2013; Luke, 2015; McHenry, Sikorski, & McHenry, 2014) and increased numbers of neuroscience related articles in professional counseling journals (Echterling, Presbury, & Cowan, 2012; Field, Beeson & Jones, 2015; Ivey, Ivey, & Zalaquett, 2011; Makinson & Young, 2012; Miller & Barrio Minton, 2016) provide scholarly evidence of this trend. Additional indicators include a new neuroscience column in *Counseling Today*, 12 neuroscience-specific presentations at the 2014 American Counseling Association (ACA) annual conference, and the recent formation of the ACA, Association of Counselor Education and Supervision (ACES), and American Mental Health Counselors Association (AMHCA) neuroscience interest networks. This surge in neuroscience related interest follows two decades of research and philosophical shifts within the larger mental health field.

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BRIEF HISTORY OF NEUROSCIENCE AND COUNSELING

The United States Congress, by Joint House Resolution 174 (1989), designated the 1990s the "decade of the brain." Shortly thereafter, advances in technology, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), provided means for studying the brain in ways previously unimagined (Linden, 2006; Schore, 2012). Researchers were able to observe specific responses of the brain (i.e., the brain "lighting up") and identify the impact of certain stimuli (e.g., counseling) on brain structure (Etkin, Phil, Pittenger, Polan, & Kandel, 2005; Ivey et al., 2011). Following the technological advances, new fields of study, including interpersonal neurobiology and neuropsychology, emerged to help integrate the emerging streams of neuroscience research with existing bodies of knowledge in counseling, developmental psychology, cognitive and affective neuroscience, education, sociology, and related disciplines (Siegel, 2012b).

In 2008, the National Institute of Mental Health shifted its research and funding agenda to emphasize neurobiological markers for pathology (Cuthbert, 2014). This new strategic plan, detailed in the Research Domain Criteria (RDoC) project, aimed for "identification of relationships among aberrations in fundamental neural systems and functional impairments – and notably including an emphasis upon neurodevelopmental trajectories and environmental factors" (p. 34). Along the same lines, President Obama unveiled the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative in April of 2013 (National Institutes of Health, 2014). The BRAIN initiative was intended to bring together researchers across disciplines to develop new technologies to explore and understand the brain with hopes of discovering causes of neurocognitive, neurodevelopmental, and other brain related brain based disorders.

Within the leading accreditation body for counselor education programs, Council for Accreditation of Counseling and Related Educational Programs (CACREP), the trend towards greater consideration of neuroscience principles is also evident. The 2009 CACREP standards (CACREP, 2009) included attention to neurobiology in only one section, human growth and development section b: "theories of learning and personality development, *including current understandings about neurobiological behavior* . . ." (italics added, p. 11). In the 2016 standards, knowledge of neurological factors and foundations are included in sections specific to professional counseling identity, addiction counseling, and clinical mental health counseling (CACREP, 2015).

Major funding and research organizations, government entities, and accrediting bodies are all recognizing and encouraging greater understanding of the role neuroscience principles play in mental health. Rossouw (2013) noted that the mental health field is "experiencing the era of neural application – applied neuroscience. No longer is neuroscience an isolated world of scientists locked in laboratories" (p. 11). Similarly, Cozolino (2010) referred to counselors as "applied neuroscientists who create individually tailored enriched learning environments designed to enhance brain functioning and

mental health" (p. 341). Counselors can play a key role in the neuroscience revolution by understanding and integrating neuroscience related information into their work and by communicating that information to clients in a way that will enhance the therapeutic process. One way counselors can accomplish this task is through neuroeducation. The definition, rationale, and process for engaging in neuroeducation will be the focus of the remaining article.

NEUROEDUCATION

Psychoeducation is an integral part of many evidence-based counseling interventions (Donker, Griffiths, Cuijpers, & Christensen, 2009; Leffler, Young, & Fristad, 2008). Leffler et al. (2008) defined psychoeducation as "a form of therapeutic intervention that combines psychotherapy and education. [It] consists of sharing information with the client that is relevant to the specific area of concern" (p. 801). Neurobiology is a specific type of information that can be shared with clients. Fishbane (2013) referred to this specialized form of information sharing as "neuroeducation." Other terms used to describe this form of education include "internal education" (Siegel, 2012a) and "brain talk" (Badenoch, 2008). This author's review of the literature failed to yield a formal definition of neuroeducation within the mental health field. Thus, the following definition is proposed for the purposes of this article: Neuroeducation is a didactic or experiential-based intervention that aims to reduce client distress and improve client outcome by helping clients understand the neurological processes underlying mental functioning. Basic schooling in the United States rarely provides individuals opportunities to learn about how the mind is shaped, regulated, and changed throughout the lifespan in response to salient environmental experiences. Clients are often eager for such information within the context of counseling (Badenoch, 2008).

A number of practitioners have reported benefits to integrating neuroeducation into their work with clients (Badenoch, 2008; Cozolino, 2010; Fishbane, 2013; Miller & Barrio Minton, 2016). Among one of the most frequently cited outcomes of neuroeducation is increased compassion and empathy for self and others. As individuals gain an understanding of neurological concepts, they are often able to release feelings of shame and blame. For example, many clients hold beliefs of innate badness or characterological weakness. Learning about certain neurological concepts, such as implicit memory, can give clients a new lens through which to understand their perceptions, impulses, emotions, and behaviors. For example, clients can shift their self-narratives from "I am the way I am because I am bad." to "I am the way I am because I adapted in the best ways I knew how to a harsh environment with hopes of getting attention, securing care, and feeling loved." New self-narratives allow for greater curiosity and openness to self-examination and growth (Badenoch, 2008; Miller & Barrio Minton, 2016).

Clinicians have also reported greater client empowerment as a result of neuroeducation. Concepts such as neuroplasticity, the brain's capacity to change in response to experience, matched with information about physiology

and self-regulation, promote a sense of encouragement and hope (Badenoch, 2008; Miller & Barrio Minton, 2016; Siegel, 2012a). Individuals typically operate on "autopilot", non-consciously relying on early learning experiences to guide present thinking and acting. Neuroeducation, in conjunction with established therapeutic approaches, can help clients modify deeply ingrained responses, allowing individuals to move from being passive observers to being active participants in their mental lives. Clients learn that change, however difficult, is possible.

Finally, neuroeducation can serve to normalize the ups and downs of the change process, leading to improved engagement in counseling (Badenoch, 2008). Clients are often discouraged when they experience a regression in treatment or continued distress; however, an understanding of how brain changes occur (e.g., the brain needs repeated disconfirming experiences over long periods of time to solidify change in the brain), the impact of stress on mental functioning (e.g., stress can inhibit consolidation and/or retrieval of new learning), and other related topics can prevent clients from resigning all efforts.

The field of neuroscience is vast; not all neuroscience research is relevant and/or practical to share with clients. In the following paragraphs, I will identify the most common neuroeducation concepts found in counseling-related literature, as well as concepts shared in my own clinical practice.

COMMON NEUROEDUCATION CONCEPTS

Neuroplasticity

Counseling goal. For much of the last century, scientists adopted a fatalistic view of neurological growth, believing that no new neural growth can occur once individuals reach a certain age (Doidge, 2007). This "theory of the unchanging brain" has since been abandoned in light of overwhelming evidence that experiences can initiate reorganization and growth in the brain throughout the life span. This process is referred to as *neuroplasticity*. Counselors benefit from understanding neuroplasticity and then sharing that knowledge with clients to encourage particular behaviors inside and outside of the counseling room that enhance therapeutic growth.

Neuroscientific basis. Siegel (2012a) identified four fundamental ways experiences can change the structure and function of the brain: (1) synaptogenesis, (2) myelinogenesis, (3) neurogenesis, and (4) epigenesis. Synaptogenesis refers to the creation of new neural connections or the strengthening of existing connections. Myelinogenesis is the process in which an insulating sheath is laid down along interconnected axons allowing for quicker neural processing. Neurogenesis is the term used to describe the "differentiation of neural stem cells into fully mature neurons" (p. 8-5). And finally, epigenesis describes the turning off or on of genes based on individuals' environmental influences. This experience-dependent nature is a fundamental principle of brain development (Perry, 2009).

Individuals' brains are most plastic (i.e., malleable) during early childhood and adolescence (Cozolino, 2010; Perry, 2009; Siegel, 2012a). During these sensitive periods in development, experiences have a disproportionate influence on developing neural pathways and networks. Experiences with heightened emotional salience and experiences that occur frequently particularly influence neural architecture. Fundamental ways of perceiving, thinking, feeling, and acting are engrained in such a way that they become largely automatic or non-conscious. These largely automatic ways of engaging with the world tend not to change without experiences that heighten awareness and challenge the status quo.

Cozolino (2010) noted that enriched environments and stimulating lives contribute to increased neuroplasticity, supporting change efforts. Researchers have identified certain activities that enhance neuroplasticity, allowing for greater openness to new learning and reorganization of neural networks (Davidson & McEwen, 2012; Siegel, 2012a). These activities include aerobic exercise, adequate sleep, healthy nutrition, relationships, novelty, the close paying of attention, and time-in.

Description of activity. Rock, Siegel, Poelmans, and Payne (2012) presented a framework for conceptualizing essential activities for optimal brain health and enhanced neuroplasticity. They called their framework the "Healthy Mind Platter," taking inspiration from more widely known frameworks for healthy eating (e.g., the Healthy Eating Plate, the Healthy Eating Pyramid). The Healthy Mind Platter consists of seven activities: sleep time, physical time, focus time, connecting time, play time, down time, and time-in, all represented in a visually appealing diagram. I developed a neuroeducation activity based on this diagram that encourages clients to consider their current functioning related to each of these activities, track behaviors, and identify and experiment with new activities to enhance the overall effectiveness of the work they are doing inside and outside of counseling. The activity is further described below.

The neuroeducation activity begins with presenting the Healthy Mind Platter diagram and describing each activity. Take special note to extend the education beyond commonly understood benefits of sleep, exercise, and so forth. For example, in explaining the neural benefits of sleep, note the role sleep plays in consolidating new learning into long term storage via certain brain structures (e.g., the hippocampus) (Siegel, 2012a). Reference a personalized piece of learning from the current or recent counseling session and stress how the clients will enhance their remembering of that learning if they obtain adequate sleep. In talking about time-in, reference recent neuroscience research on the impact of various forms of meditation and mindfulness practices on the left prefrontal region of the brain (Davidson & McEwen, 2012; Witkieqitz, Lustyk, & Bowen, 2013). Share that engaging in such practices strengthens their prefrontal cortex's ability to inhibit subcortical reactivity (e.g., emotional outbursts, cravings and urges, panic attacks). Ask clients to estimate how often, or if at all, they engage in each of the seven activities. First respond to identified areas of strength, providing encouragement and affirmation for

continued practice. Then work with clients to brainstorm ways they can engage in activities they are not yet regularly or adequately practicing. Clients identify goals and report back on their efforts in subsequent counseling sessions. Facilitate continued monitoring and modification related to each of the seven essential activities throughout the counseling process. Clients have expressed appreciation for a simple and clear diagram, as well as for a structured format for evaluating and tracking related behaviors. They have also reported feeling motivated by the neuroscience justification for each activity.

Brain Structures and Functions

Counseling goal. A reductionist approach, overemphasizing the role of a single brain structure, can miss the bigger picture of the brain as a complex and interconnected system that is ever adapting to environmental conditions and relationships (Luke, 2015). There are some advantages, however, to identifying "isolated" brain structures and functions in the context of neuroeducation. Benefits include an increased understanding of distress from a brain development perspective (e.g., experiences have varying impacts on the brain, and related mental functioning, depending on age) (Perry, 2009) and an ability for clients to visualize their minds in a way that assists with regulation (Siegel, 2012b). As noted previously, these outcomes are helpful in decreasing shame and increasing hope. The structures and functions include those associated with the brain stem, limbic, and cortical regions.

Neuroscientific basis. Various terms can be used as labels for these broadly defined regions (Cozolino, 2010). Although some individuals like memorizing scientific jargon, many clients prefer using more familiar words that they can relate to existing knowledge. Examples of terms used to describe these brain structures include upstairs brain and downstairs brain; lower brain, mid brain, upper brain; reptilian brain, mammalian brain, and primate/human brain; and the alligator, the dolphin, and the human.

A brief description of each brain region is provided below. However, for a more comprehensive explanation of these systems, one of the many texts referenced in this article are recommended (See Badenoch, 2008; Cozolino, 2010; Siegel 2012b). The brainstem is the first structure to develop, beginning in utero (Perry, 2009). This region mediates states of arousal, temperature, respiration, heart rate, and aspects of the fight-flight-freeze threat response. The processes of this region usually occur without much thought or intentional action. The limbic region plays an important role "in mediating emotion, motivation, and goal-directed behavior, as well as in the integration of memory and the engagement of an attachment system" (p. 18). This region is a primary focus of development during infancy and early childhood. The cortex region, specifically the prefrontal cortex region, plays a salient role in integrating information from the brainstem and limbic regions, inhibiting these subcortical impulses, and initiating executive functions (e.g., concentration, reasoning, long-term thinking and planning, and so forth). This part of the brain is the

slowest to develop and myelinate, often not reaching full maturity until late in the 20s (Jensen & Nutt, 2015).

Description of activity. An excellent exercise to use with clients to teach brain structures and functions is the Hand Model of the Brain (Siegel, 2012b). In this activity, clients are asked to hold up one of their hands, fold in their thumb, and then fold their other four fingers over their thumb. The wrist/palm area is roughly labeled the brainstem, the thumb area the limbic region, and the fingernails folding over the thumb the prefrontal cortex. Dominant functions of each of those broad regions are described, as well as basic principles of brain development (e.g., bottom-up; back-front). Siegel's recorded teaching of the Hand Model of the Brain (Siegel, 2010) is a useful option to consider when counselors are less confident of their abilities to describe neuroanatomy but still want to share the information and integrate it into therapeutic discussions. As counselors become more confident in their abilities to explain the Hand Model, they can tailor specific explanations to the unique needs of individual clients.

A component of the Hand Model exercise includes a discussion of "flipping the lid" (Siegel, 2012a). This metaphor is used to describe what happens in the brain when the prefrontal cortex is unable to inhibit subcortical (e.g., brainstem and limbic) surges due to heightened levels of stress and/or a poorly developed cortex resulting from trauma, substance use, or other conditions. This exercise can be used to help explain part of what happens when clients make progress in cognitive and behaviorally oriented therapies, primarily impacting cortical level processes, and then suddenly regress during times of elevated stress. Encouraging practices that help strengthen the cortex, such as aerobic exercise and mindfulness meditation is essential (Davidson & McEwen, 2012; Witkiewitz et al., 2013), as well as teaching strategies for calming physiological arousal (e.g., breath awareness, mindset interventions), in order to help prevent limbic override. However, often, just helping clients visualize what is going on in their brains during such instances of elevated stress can help clients regulate.

Clients have responded enthusiastically to the Hand Model exercise. They reported experiencing less shame over past failures to manage their emotions, as well as appreciation for having a visual tool to remind them of the concepts. The Hand Model also gives clients a new language to use in talking about patterns of dysregulation (Badenoch, 2008).

Memory Phenomena

Counseling goal. Memory is defined as "the process by which knowledge is acquired, codified, stored, and retrieved" (Cappas, Andres-Hyman, & Davidson, 2005). Memory is the manner in which past events impact current and future perceiving, thinking, feeling, and acting (Siegel, 2012b). Engaging in memory-based neuroeducation is helpful because most clients do not have an accurate understanding of memory despite the fact that various memory phenomena so deeply influence their senses of self, others, and the world.

Common misconceptions about memory include the belief that individuals are always aware of what they experience, that memory always includes a sense of recognition, and that memories are accurate representations of past events. Thus efforts to engage in neuroeducation on this topic include differentiating memory phenomena (i.e., different ways of 'knowing') and specifically exploring and facilitating the integration of implicit memories (Schore, 2012).

Neuroscientific basis. Two broad forms of memory phenomena are identified in neuroscience literature, explicit (declarative) memory and implicit (nondeclarative) memory (Kandel, 2009; Paller et al., 2009). Explicit memory requires conscious attention for encoding and includes recall of facts and events. Remembering I ate Cheerios for breakfast this morning or recalling what the hotel looked like on a vacation to Florida five years ago are examples of explicit memory. Implicit memory, on the other hand, does not require conscious attention for encoding and reveals itself in perceptions, emotions, behavioral impulses, bodily sensations, and other intuitive reactions rather than a conscious sense of remembering a past event. Developing a sinking feeling in my stomach, experiencing a sharp pang of fear, and having the impulse to run when faced with a similar type of dog that bit me when I was too young to explicitly remember are examples of implicit memory at work. Implicit memory is the dominant form of memory during infancy and early childhood, serving as building blocks for mental models such as attachment styles (Siegel, 2012b). Mental models are ways in which the brain makes biased generalizations based on past experiences and applies them to anticipate and act in the future.

Implicit memory plays a particularly salient role in cases of trauma (Perry, 2009; Schore, 2012). Stress hormones released during traumatic events can impair hippocampal functioning leading to impaired integration. Impaired memory integration includes many of the symptoms of Post-Traumatic Stress Disorder, including nightmares, flashbacks, and dissociation (Siegel, 2012b). Chronic stress can decrease hippocampal volume, affecting individuals' ability to learn and retain new information. Implicit memories often become self-fulfilling prophecies as individuals anticipate and then create relational dynamics consistent with those expectations (Badenoch, 2008). For example, children who experience abuse early in life often develop a negative self-concept, leading to acting out behavior that draws negative attention, reinforcing their sense of badness.

Description of activity. Cozolino (2010) made an analogy to an iceberg to describe memory phenomena. The top of the iceberg emerging above water represents explicit memory and the larger portion of the iceberg under the water represents implicit memory. Expansion of this analogy into a neuroeducation exercise shares much of the same information detailed above, highlighting the nature and influence of implicit memory and the possibility of greater awareness and integration of implicit biases. Ask clients to think of a time when they reacted to a situation with strong emotion or automatic behavior. Note that perhaps other people pointed out that their responses were misplaced or out of proportion to the situation. Invite them to bring to mind body-felt sen-

sations (e.g., chest pain, butterflies in stomach), any behavioral impulses (e.g., freeze, run, hit), and any images. Direct clients to stay with any strong body sensations, impulses, and images, thinking back to other times they may have experienced similar embodied reactions. Sometimes implicit memories can be traced to a specific incident, whereas other times the exact incident remains unknown. Regardless, clients can gain awareness of the presence and influence of implicit memories, learning to pause and reflect before acting. Individuals learn to challenge the absoluteness of their assumptions, gaining a sense of humility and compassion.

Badenoch (2008) noted that understanding knowledge of implicit memory can be freeing. "Rather than being swept away by our reactions, such awareness encourages the ability to step back from the tight grip of our current experience and to notice how our minds are pulled in one direction or another" (p. 275). Awareness allows for choice and the possibility of change (Siegel, 2012b). Clients' responses to this activity have echoed this experience. Specifically, they have reported having a sense of increased options and increased control over their lives.

BEST PRACTICES FOR IMPLEMENTATION

Counselor Competence

The first step in the neuroeducation process is increasing counselors' mastery of neuroscience-related topics. The American Mental Health Counselors Association Code of Ethics (2010) calls for counselors to "maintain knowledge of relevant scientific and professional information" and to be "open to new counseling approaches and procedures documented by peer-reviewed scientific and professional literature" (pp. 8-9). Counselors have a number of viable options for obtaining continuing education in neuroscience-related topics, including attending neuroscience related workshops at professional conferences, reading one of the many newly published texts and journal articles linking counseling and neuroscience, and pursuing training through established organizations. Increasingly, universities and training companies offer certificate and continuing education workshops in topics related to neuroscience and counseling.

When selecting neuroscience-related continuing education opportunities, I encourage practitioners to consider emerging literature on the neuroscience of learning. From a neural perspective, not all learning experiences are created equal. Cozolino and Sprokay (2006) identified five necessary components for deep learning (p. 12): (1) a safe and trusting relationship with an attuned other, (2) maintenance of a moderate level of arousal, (3) activation of both thinking and feeling, (4) language of self-reflection, and (5) co-construction of narrative that reflects a positive and optimistic self evocation of emotion and interpersonal connection. Miller and Barrio Minton (2016) found that participants learning interpersonal neurobiology attributed much of their learning to an experiential teaching style and opportunities to reflect and apply neuroscience

principles to their personal lives throughout the learning process. Counselors must have an opportunity to apply and integrate neuroscience principles into their own lives before sharing such applications with clients.

An essential next step in the learning process includes receiving supervision and/or consultation (AMHCA, 2010). When counselors do not have access to supervisors trained in how to apply neuroscience principles to counseling, professionals can consider forming small group learning communities to share their struggles and successes of engaging in neuroeducation and offer each other feedback and support. Examples of existing opportunities include groups organized by Austin in Connection (http://austininconnection.org/) and Nurturing the Heart with the Brain in Mind (http://www.nurturingtheheart.org/).

Client Readiness

Consideration of clients' readiness and openness to neuroeducation is an important aspect of the implementation process. Miller and Rollnick (2013) presented an elicit-provide-elicit framework for sharing information with clients that can be applied to neuroeducation. Using this model, counselors begin the neuroeducation intervention by asking clients what they already know about a particular topic and/or soliciting permission to share information. With clients' permission, counselors then proceed to engage in education on a neuroscience-related topic. Counselors end the information sharing process by asking clients what they think of the information and/or how they see the information applying to their lives. Throughout the information sharing process, counselors assess clients' levels of interest and engagement. Although many clients find neuroscience information interesting and useful (Badenoch, 2008; Miller & Barrio Minton, 2016), not all clients will respond positively. In such instances, counselors should end the neuroeducation intervention and seek to reconnect with their clients and consider interventions that are more in line with clients' current needs.

In general, the best time to engage in neuroeducation is when clients' here-and-now presentations are relevant to the neuroscience principle(s). Accurate timing of information sharing can allow clients to gain an embodied sense of the material, a felt sense of how the neuroscience principle is playing out in their bodies, minds, and relationships, whereas inaccurate timing of information-sharing can leave clients feeling bored and/or confused. Luke (2015) noted that "disembodied, decontextualized data and facts often divide in therapy rather than unite" (p. 19). When counselors have to present pre-selected neuroeducation material, as is often the case with psychoeducational groups, counselors should attempt to connect the information to the clients' lives as much as possible. Inclusion of experiential activities can help facilitate relevance when here-and-now presentation of neuroeducation is not possible.

IMPLICATIONS FOR RESEARCH

Many anecdotal and case study reports of neuroeducation interventions exist within the mental health literature (Badenoch, 2008; Cozolino, 2010; Miller & Barrio Minton, 2016); however, a thorough review of the literature failed to yield any empirical studies on the topic. Empirical research is needed to explore the various client and counselor variables related to neuroeducation, including exploring the most effective ways to integrate neuroeducation into clinical practice, and designing and validating neuroeducation curricula. Finally, researchers need to evaluate the impact of neuroeducation on client outcomes (e.g., increased knowledge, increased coping, and decreased symptomology), explore which neuroeducation topics are most interesting and/or relevant to clients, and examine how clients integrate their learning about neuroscience into their change processes.

CONCLUSION

Neuroscience is considered the fifth force in the counseling field (D'Andrea, 2012; McHenry et al., 2014). Many counselors are still adjusting to this growing force, seeking ways to integrate neuroscience into their clinical work. Neuroeducation offers one such way. Three broad categories for neuroeducation were presented in this article; however, many more such topics exist. Other potential neuroscience principles to consider for neuroeducation include information regarding right/left hemispheres, the impact of certain toxins (e.g., drugs, alcohol, pollution) on neural development and functioning, and the role of the Autonomic Nervous System (ANS). Counselors can be creative in their presentation of neuroeducation material, adjusting language and depth based on clients' developmental levels and interests.

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