THE UNIVERSITY OF TENNESSEE KNOXVILLE

Teaching and Supervision in Counseling

Volume 7 | Issue 1 Article 3

January 2025

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Cover Page Footnote

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. The authors reported no financial support for the research, authorship, and/or publication of this article.

TEACHING AND SUPERVISION IN COUNSELING
The official journal of the Southern Association for Counselor Education and Supervision

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Received: 01/18/2024
Revised: 05/01/2024
Revised: 07/30/2024
Accepted: 08/05/2024
DOI: 10.7290/tsc07jkay

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Abstract

Although advances in neuroscience validate the therapeutic practices and professional identity of counselors, educators struggle to infuse accurate neuroscience knowledge into the classroom. Utilizing a quasi-experimental, repeated measures design, this study examined the effectiveness of a neuro-informed lecture in reducing neuromyth endorsement among graduate students enrolled in the counseling theories course. Participants (N = 62) completed a demographics questionnaire and identical neuroscience pre- and post-surveys. The intervention group (n = 32) received the lecture-based intervention, while those in the comparison group (n = 30) did not. Results revealed significant improvement in neuroscience knowledge scores for those receiving the lecture (pre: M = 41.47, SD = 3.689; post: M = 45.25, SD = 3.203; $t(31)$ = -4.082, p = 0.0003, Cohen's d = -0.722), while the comparison group experienced minimal change. Findings suggest the effectiveness of lecture interventions in enhancing neuroscience understanding and reducing neuromyth endorsement in counseling theories students.

Significance to the Public

This study utilizes a quasi-experimental, repeated measures design to examine if delivering a neuro-informed cognitive behavioral therapy lecture would minimize the acceptance of neuromyths from counselors-in-training enrolled in a foundational theories course. Results suggest that the integration of accurate neuro-informed knowledge into prepracticum counseling classes increases students' general neuroscience awareness and ability to dispel neuromyths.

Keywords: neuromyths, neuro-informed cognitive behavioral therapy, student learning, counselor education, course lecture

Neuro-informed counseling combines principles of neuroscience and professional counseling to enhance comprehension of human behavior and emotions (Field et al., 2017). Understanding how physiology influences an individual's thoughts, feelings, and behaviors helps clinicians tailor their interventions appropriately when addressing client needs (Ivey & Zalaquett, 2011). Offering neurological insight toward mental health builds upon the profession's humanistic roots, offers clarity for clients regarding possible biological explanations for some of their experiences (Beeson & Miller, 2019), and promotes positive change using informed therapeutic interventions (Field et al., 2017). The task of ensuring that counseling students receive accurate neuro-informed knowledge falls on counselor educators.

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Counseling programs increasingly integrate neuroscience knowledge into curricula (Field et al., 2017; Romero et al., 2020) to emphasize how diverse factors, such as biological variables (i.e., neuroplasticity), impact social injustices such as poverty, abuse, trauma, and racism (Ivey & Zalaquett, 2011). Despite well-intentioned counseling programs advocating for the inclusion of neuro-informed learning, ethical concerns arise concerning unclear training standards (Luke et al., 2019), uninformed educators (Beeson et al., 2019), and the persistence of inaccurate understandings (e.g., neuromyths) within higher education (Kim & Zalaquett, 2019). Additionally, the exclusion of neuro-informed learning and proliferation of neuromyths could ultimately impact the quality of services provided by counselors-in-training by increasing inaccurate psychoeducational risk to clients and decreasing the use of biologically founded understandings of change. Research in teaching echoes this concern, cautioning the potential for consequences in the quality of education resulting from neuromyth-grounded instructional methodologies (Ferrero et al., 2020). To begin addressing these questions, counselors and counselor educators must become aware of misconceptions regarding the brain and learning and then work to provide accurate information within their prospective environments (Howard-Jones, 2014).

Neuroscience in Counseling and Counselor Education

As a profession, counselors are integrating brain-based information into clinical practice and education. Advances in neuroimaging support the efficacy of counseling, as affiliated research validates therapeutic approaches utilized by mental health clinicians (Yen et al., 2023). These findings have prompted reciprocal interest in the development and usage of interventions aimed toward effecting specific neurobiological changes, such as polyvagal theory and eye-movement desensitization and reprocessing. In response to increased interest, organizations such as the American Counseling Association (ACA), the American Mental Health Counseling Association (AMHCA), and the Association for Counselor Education and Supervision (ACES) previously created neuroscience interest networks. Additionally, AMHCA (2023) and the Council for the Accreditation of Counseling and Related Educational Programs (CACREP; 2023) outlined neuroscience standards that counseling graduate programs must address in student training. While program standards and ethical requirements for neuro-informed education exist, current guidelines for effectively incorporating this knowledge into existing counseling curriculum are minimal. Attending to this dilemma, an AMHCA taskforce developed a four-level training model (i.e., foundations, clinical presentations, theories and applications, and specializations) for implementing neuroscience knowledge acquisition in counseling coursework (Field et al., 2022). In tandem with AMHCA's (2023) and CACREP's (2023) affiliated neuro-informed training standards, the taskforce's framework provides a logical structure for assessing adherence to specific counseling accreditation standards and offering deliverables to interested students or educators hoping to integrate material into their respective courses. Although AMHCA's (2023) model and CACREP's (2023) standards provide guidance regarding the development of neuro-informed competence, interested clinicians, educators, and students remain tasked with compiling appropriate material attending to these recommendations. Thus, attention to more focused didactic and instructional strategies, such as when to specifically integrate neuro-informed material into lecture-based learning and affiliated activities, are needed for educators to begin broaching these concepts in the classroom or curriculum successfully.

Neuromyths in Counselor Education

A neuromyth is a misconception or misunderstanding about the brain and how it functions (Organization for Economic Co-Operation and Development [OECD], 2002). Neuromyths exist and persist for various reasons: inaccurate understanding of scientific literacy, confirmation

bias, or accessibility of inaccurate information in popular media (Beck, 2010; Beeson et al., 2019). Popular media also perpetuates neuromyths by oversimplifying information, creating the detrimental effect of increasing accessibility while sacrificing accuracy (Beck, 2010). This combination of possible outlets decreases the ability for those not within a neuroscientific field to discern accurate information successfully (Dekker et al., 2012). Further, previous studies investigating neuromyth endorsement also did not suggest increased neuroscience literacy as a protective factor for non-neuroscience teaching professionals (Dekker et al., 2012; Im et al., 2018). Consequently, neuromyth acceptance has demonstrated high systemic resistance to reevaluation and change despite exposure to accurate information (Macdonald et al., 2017), amplifying the challenge for neuroscience-informed educators in dispelling these myths (Dekker et al., 2012).

While educators and students alike express interest in the application of neuroscientific research in the classroom, the literary and focal differences between education and neuroscience disciplines impede the expansion of brain-based literacy (Kim & Zalaquett, 2019). Empirical research on this topic demonstrates pervasive acceptance of neuromyths relating to brain-based learning and processing both among the general public and educators (Dekker et al., 2012). In fact, the most prevalent neuromyths directly relate to learning processes (Torrijos-Muelas et al., 2021) and are often exacerbated by well-intentioned educators hoping to integrate applicable neuroscience findings into their teaching strategies (Dekker et al., 2012). For example, Torrijos-Muelas et al. (2021) conducted a systematic review of 24 neuromyth-related articles and found a belief prevalence of up to 84.5% among educators. Based on the pervasiveness of neuromyth endorsement, researchers suggest a potential impact on teaching practices and the passage of accurate, brain-based knowledge (Dekker et al., 2012). Consequently, acceptance of neuromyths among educators likely influences student outcomes by perpetuating the transmittal of inaccurate information in educational content and learning strategies (Ferrero et al., 2020) and myths (Dekker et al., 2012).

In addressing the persistence of neuromyths among educators, researchers have also focused on intervention strategies and enhancing neuroscience literacy to counter these misconceptions within student populations (Im et al., 2018). However, limited inquiry has been directed toward understanding the proliferation of neuromyths and their impact on other helping professions or social science disciplines (Kim & Zalaquett, 2019; Novak-Geiger, 2023). To bridge this gap, efforts have been made to investigate the prevalence of neuromyths among individuals provisionally pursuing careers in helping professions, such as clinical mental health counseling. For instance, Kim and Zalaquett (2019) surveyed 125 undergraduate students enrolled in related programs to gauge their acceptance of neuromyths and their intention to apply neuroscience knowledge in their future professional endeavors. The results revealed high levels of neuromyth beliefs alongside intentions to integrate neuroscientific knowledge into their future practices. These findings underscore the importance of educators providing accurate neuroscience training materials (Field et al., 2022) to prevent the perpetuation of neuromyths within counseling training, as the acceptance of neuromyths can impact educational outcomes and subsequently affect treatment efficacy and therapeutic processes (Redifer & Jackola, 2022).

The counseling profession has recently begun incorporating neuroscience topics into their graduate programs (Romero et al., 2020). However, despite these efforts, counseling students and professionals may still hold misconceptions about brain biology and functioning. In a survey of 260 AMHCA members, Russo et al. (2021) discovered that there were significant deficiencies in neuroscience training for counselors, especially in foundational knowledge. This gap highlights the importance of including accurate neuroscience knowledge in counseling education to refute the perpetuation of neuromyths but promote evidence-informed practices and ethical integration (Kim & Zalaquett, 2019; Russo et al., 2021). Failure to

incorporate correct neuro-informed learning could impact the quality of counseling services by increasing the risk of providing inaccurate psychoeducation to clients and hindering the utilization of biologically grounded understandings of change (Ferrero et al., 2020). Additionally, if unaddressed, neuromyths within counselor education could exacerbate current hesitations specific to the misalignment with counselor identity (Wilkinson, 2018), challenges in accessing and evaluating neuroscience literature (Kim & Zalaquett, 2019), and the potential risk for harm (Luke et al., 2019).

Neuro-Informed Cognitive Behavioral Therapy

Introduced in the *Journal of Mental Health Counseling*, Field et al. (2015) presented neuro-informed cognitive-behavior therapy (nCBT), a theoretical model that integrates concepts of neuroscience with traditional understandings of cognitive-behavior therapy (CBT). Following its initial publication in 2015, nCBT researchers continue to report encouraging results relating to treatment fidelity (Field et al., 2019) and perceived effectiveness (Field et al., 2017) when blending the model in the therapeutic setting. For instance, to build upon previous credibility data, Miller et al. (2020) conducted a 3-day training with 42 mental health professionals with the intention of measuring enhanced interoceptive awareness and knowledge of nCBT concepts. Adhering to the affiliated nCBT treatment manual (Beeson et al., 2017), training involved participants learning basic neuroanatomy principles, such as brain development, information processing, and related functions of the nervous system. The participants also acquired knowledge of how nCBT encourages and informs certain therapeutic interventions. Concluding the training, Miller et al. (2020) found an overall increase in practitioners' interoceptive awareness and understanding of nCBT concepts.

Initially, to expand upon Ellis's ABCDE model of Rational Emotive Behavioral Therapy (REBT; Ellis, 1957), the nCBT approach posits that counselors and clients utilize the therapeutic relationship to examine possible connections between activating events (e.g., doctor suggests you lose weight), beliefs (e.g., I am unhealthy), and resulting emotional or behavioral consequences (e.g., over-exercising). While nCBT acknowledges the benefits of the existing cognitive models, the approach expands understanding to address contributing factors that rest outside of an individual's awareness and divides these levels of consciousness into a dual form of information processing (e.g., top-down, bottom-up) known as The Waves of the ABCs (Field et al., 2015). This modified framework can guide clinician intervention and treatment selection based on how a client presents and responds (Field et al., 2019), permitting increased awareness and informing more intentional treatment approaches.

Wave One

The first wave, which utilizes bottom-up processing, functions outside of an individual's awareness. Characterized by instinctive, physiological reactions and a lack of conscious thought, Wave One occurs within the subcortical brain structures and encompasses three stages: (A1) the activating event, (B1) brain response from the bottom structures up, and (C1) initial signs registering throughout the system (Field et al., 2015). The activating event (A1) can be any occurrence that initiates sensory stimuli, such as people, places, circumstances, and memories. Once an initial activating event occurs, the brain interprets the information quickly and largely outside of the individual's awareness (B1). Finally, the body will begin to register physiological symptoms (C1) including sweating and increased heart rate.

Wave Two

Second Wave information processing involves conscious evaluation and response to preconscious neurobiological events occurring in Wave One. Wave Two consists of three stages corresponding to the respective phases of Wave One: (A2) awareness of Wave One consequences, (B2) brain response

reappraising stimuli critically from the top structures down, and (C2) secondary emotional and physiological consequences (Field et al., 2015). Individuals develop conscious awareness (A2) of the automatic responses that occurred during Wave One. Following this awareness, the prefrontal cortex reappraises the initial consequences of the activating event and passes judgment (B2), such as feeling embarrassment or shame. This critical stage serves as the main avenue for most cognitive-behavioral interventions, as most faulty evaluations and distortions occur at this point. New emotional, behavioral, and physiological responses (C2) ensue, initiating a chain reaction of reappraisals and responses removed from the original activating event.

Purpose of the Study

Considering the dearth of neuromyth-oriented literature exploring refutational interventions (Grospietsch & Lins, 2021; McMahon et al., 2019) specific to students, the researchers sought to investigate the impact of a lecture-based intervention on neuromyth endorsement. Additionally, this article seeks to provide helpful preliminary inquiry regarding the role of neuromyths in counselor education, as most literature examines neuromyth acceptance in fields outside the helping professions.

For this study, the researchers chose a counseling theories course to deliver the intervention nCBT lecture. Specifically, the counseling theories course provides novice students with a solid framework for understanding the historical significance and practical techniques of the profession of counseling (Day, 2008). Counseling programs include introductory classes, such as counseling theories, early in the graduate course sequence as they offer a robust foundation for exploring professional development and establishing a solid footing. Accordingly, when students later reach the clinical sequence of practicum and internship courses, they have invested considerable time in developing their personal theoretical orientation (CACREP, 2023). In an effort to maintain homogeneity between comparison groups and offer material paralleling topics discussed within a counseling theories course or typically broached early in a student's academic experiences, we opted to limit the inclusion of participants to only those enrolled in a counseling theories or students considered prepracticum. All other students falling outside of this designation (i.e., those enrolled in practicum or another clinical course) were excluded from this study. Limiting participants to these fixed parameters allows for greater control of external variances and increases the precision of generalizability regarding the intervention's effectiveness to a defined group. For those meeting inclusion criteria, we filtered students into either an intervention or comparison group, dependent on their current enrollment status in a counseling theories course. Based on these criteria, the research question is: *Would the acceptance of neuromyths differ for graduate students enrolled in a counseling theories course when administered an nCBT lecture integrating accurate neuroscience representations from Kim and Zalaquett's (2019) neuromyths survey?*

Method

Participants

The researchers conducted this study during the 2023 spring and fall semesters at a large public CACREP-accredited university in the Southwest region of the United States. Before collecting any data, we first received approval from the affiliated university's institutional review board. Utilizing convenience, criterion-based, and stratified random sampling methods, we provided graduate-level counseling instructors teaching a prepracticum course with a Qualtrics survey link to be dispersed to their students. Instructors independently decided whether to offer extra credit for participation. To protect student confidentiality from the study's researchers, the Qualtrics survey prompted individuals to create a pseudonym that was used to match pre- and post-assessments during the data collection process. From students interested in participating, an initial sum of 129 counselors-in-training completed a demographics questionnaire

and the neuromyths pre-assessment. To verify that students met inclusion criteria, the survey asked individuals to indicate (a) current enrollment status in a counseling theories course; and (b) if they are currently enrolled in or have completed a clinical counseling course (i.e., practicum, internship). Of those students, 21 (16.28%) responses fell outside the study's inclusion criteria and were dismissed due to indicating current enrollment in the graduate program's practicum course. Further, although 108 (83.72%) participants met inclusion criteria, a final sample size of 62 (48.06%) students completed both pre- and post-surveys, as 46 (35.66%) only completed the initial assessment. For those who completed both surveys, 32 (51.61%) were enrolled in the theories course and comprised the intervention group, while the remaining 30 (48.39%) students self-identified enrollment in a designated prepracticum class and were placed within the study's comparison group. As an incentive for those not receiving the lecture-based intervention, participants within the comparison group gained access to the recorded intervention lectures following the conclusion of the study.

Concerning demographic information and to understand the diversity of our sample size, most participants identified as female (*n* = 49, 79.03%), with 12 (19.35%) students identifying as male, and one (1.61%) student identifying as nonbinary. For racial identity, participants self-identified as White (*n* = 24, 38.71%), Hispanic (*n* = 21, 33.87%), biracial (*n* = 9, 14.52%), multiracial (*n* = 3, 4.84%), and Asian (*n* = 3, 4.84%), and two (*n* = 2, 3.22%) participants preferred not to state their racial identity. The researchers also asked participants to indicate the number of semesters they have been enrolled in the counseling graduate program. Concerning enrollment, 36 students (58.06%) indicated being enrolled in their first semester, while the remaining participants relayed having been enrolled in the graduate program for either two semesters (*n* = 18, 29.03%), four or more semesters (*n* = 7, 11.29%), or preferring not to answer (*n* = 1, 1.61%). Regarding specific program tracks, 59 (95.16%) students indicated that they were pursuing a degree in clinical mental health counseling, whereas three (4.84%) students responded they were working toward a degree in school counseling. Lastly, 25 (40.32%) students identified as first-generation college students.

Instrumentation

Students who chose to participate in the present study completed a short demographics questionnaire on gender identity, racial/ethnic identity, number of semesters enrolled in the counseling program, specific program track, and whether an individual identified as a first-generation student. Participants also completed 17 questions identical to that of Kim and Zalaquett's (2019) neuroscience knowledge assessment. These questions gauged participants' understanding about the brain and learning. Specifically, 11 questions encompassed common assertions found in Dekker et al. (2012; e.g., "We use our brain 24 hours a day"), while the remaining six questions incorporated inaccurate neuromyths as articulated by OECD (2002) and Howard-Jones et al. (2014; e.g., "There are critical periods in childhood after which certain things can no longer be learned"). When completing the survey, participants answered the questions with either *correct*, *incorrect*, or *do not know*. Following the nCBT lecture, we provided all participants, regardless of study-design group designation, with another Qualtrics link to complete the same neuroscience knowledge questions asked in the initial survey. Although the original study containing the neuroscience assessment did not indicate an internal consistency reliability specific to the questionnaire of the brain and its influence on health and behavior, the present study yielded a Cronbach's alpha coefficient of .691.

Procedure

Lecture Development

With the intention of delivering a comprehensive counseling theories lecture that encompassed the accurate neuromyth literacy from Kim and Zalaquett's (2019) survey, we unanimously chose to follow *nCBT: A semi-structured multiphasic treatment manual* (Beeson et al., 2017) as a guiding framework. The researchers determined the

usefulness of this manual as the theory was conceptualized by counselor educators (Field et al., 2015), the content offers an exhaustive description of nCBT, and the text has been previously used in literature to measure enhanced knowledge and acceptance of neuro-informed counseling concepts (Miller et al., 2020). Most notably, the manual structure provides relevant opportunities to incorporate accurate neuroscience information covertly that dispels common neuromyth assumptions. After deliberating as a research team, we agreed on the following nCBT classroom lecture outline: (a) introduction to traditional cognitive theories (Beck, 1979; Ellis, 1957), (b) brain development and communication, (c) overview of Wave One and Wave Two, and (d) clinical implication and associated therapeutic interventions. Prior to assembling the classroom lecture, we contacted the primary author of the nCBT training manual and received approval to incorporate the material into this study.

After deciding upon the lecture framework, the first three authors, who possess unique areas of clinical experience and expertise related to neuro-informed interventions and counseling modalities, met weekly for a month to deliberately embed accurate information that covertly addressed all neuromyth items found in Kim and Zalaquett's (2019) survey. We determined item placement based on relevance to nCBT manual sections. For instance, information negating the neuromyth, "Differences in hemispheric dominance (left brain, right brain) can help explain individual differences amongst learners," was intentionally incorporated into the lecture portion dedicated to hemispheric asymmetry. In addition to addressing neuromyths, we deliberately affirmed general neuroscience knowledge items (Kim & Zalaquett, 2019) within the lecture to address both neuromyths and present factual neuroscience information. To mitigate researcher bias, all authors approved the final lecture outline. To ensure intervention fidelity, instructors created detailed note scripts on each presentation slide to maintain consistent verbiage on neuromyth and neuroscience information.

Lecture Implementation

A week before delivering the nCBT lecture, the prepracticum instructors provided an email to their students that included the study recruitment script, purpose and scope, inclusion criteria, participant expectations, and a Qualtrics hyperlink to complete the demographics, informed consent, and initial survey. Concluding the first survey, the first three authors implemented identical experimental 1-hour nCBT lectures to the graduate program's three master's counseling theories courses in online and in-person formats. Due to convenience sampling the researchers presented the intervention material to a theories course that utilized an in-person classroom format, while the remaining two lectures were conducted online. With the attempt to facilitate class engagement, we incorporated learning strategies including storytelling, discussions, visual enhancements, and classroom interaction. For example, when exploring students' present knowledge of Aaron Beck's (1979) conventional CBT model, we role-played affiliated techniques found within the nCBT manual such as "downward arrow," "flooding," and "thought stopping." The student-selected role-play interventions were consistent across experimental groups. These activities helped refresh student comprehension of cognitive behavioral underpinnings before introducing the new, neuro-informed material.

Following the discussion of foundational CBT concepts, we again facilitated an active, discussion-based learning environment in which students made connections between their subjective experiences and the newly introduced nCBT material. We illustrated the influence of nCBT preconscious factors (Wave One) by providing relevant clinical vignettes articulating sympathetic nervous system activation processes and explained how talk therapy traditionally targets conscious behaviors/emotions/responses (Wave Two). We utilized the same clinical vignettes across all intervention groups. To conclude the experimental lecture, we described examples of empirically based counseling approaches that affirmed the integration of neuroscience and counseling (e.g., neurofeedback, mindfulness, therapeutic lifestyles

changes). A week following the nCBT lecture, we provided the same neuromyths survey to all study participants. We notified all prepracticum students outside of the theories courses that a Zoom recording of the nCBT lecture was available following the completion of the postsurvey.

Data Analysis

This study applied a quasi-experimental, repeated measures design to examine potential statistical significance within the two groups. Specifically, following the collection of post-surveys, we filtered all submissions to verify that individuals met inclusion criteria and completed both surveys. We then downloaded the responses from Qualtrics and uploaded the answers into Microsoft Excel to prepare for data analysis. Participants' responses were categorized appropriately as either experimental or comparison and reviewed for missing data. Because the survey collected answers as *correct*, *incorrect*, or *do not know*, we assigned a numerical value of 3 to each "correct" answer, a 2 to an "incorrect" selection, and 1 to any "do not know" responses. A participant score of 51 would indicate that all questions had been correctly answered. After categorizing participant responses in Microsoft Excel, we uploaded the data into SPSS (version 28) and implemented a paired-samples *t* test for each group to observe if the presence or lack of the nCBT lecture statistically impacted students' knowledge and acceptance of neuromyths.

Before analyzing the collected data, the authors calculated the optimal sample sizes needed to infer a medium effect size (d = .5; Cohen, 1992) with a 95% confidence interval. Measuring the Cohen's d is a valuable tool in research as it assesses the practical significance of an observed effect and promotes generalizable understanding. We also utilized a power level of .80, indicating an 80% likelihood of detecting an existing effect. With these parameters, a sample size of 27 participants was computed for a one-tailed, paired samples *t* test using G*Power, a free software tool to calculate statistical power. Thus, our final sample size met data saturation as the experimental (n = 32) and comparison (n = 30) groups exceeded the required needed amount.

Results

The results of the paired samples *t* tests conducted on the experimental and comparison groups revealed significant differences in pre- and post-neuroscience knowledge assessment scores. For students that took part in the nCBT lecture, a statistically significant improvement was measured between pretest (M = 41.47, SD = 3.689) and posttest (M = 45.25, SD = 3.203), $t(31) = -4.082$, $p = 0.0003$, Cohen's d = -.722), indicating a medium effect size in accurate neuroscience understanding. Effect size is important, as the value provides a numerical measure of strengths for an observed variable and generates reliable population generalizability when compared across affiliated studies (Schäfer & Schwarz, 2019). Conversely, prepracticum participants not enrolled in the theories courses displayed no significant change in assessment scores from pretest (M = 40.23, SD = 5.9) to posttest (M = 40.36, SD = 6.122), $t(29) = -.278$, $p = 0.783$, Cohen's d = -.051). Post hoc power analyses were also conducted through G*Power to determine the observed power of the paired samples t-tests. For the intervention group, the observed power was calculated as 0.991. For the comparison group, the observed power was 0.087. Based on these findings, we rejected the null hypotheses as the observed improvements in student participating in the lecture-based intervention highlights the specific impact on the acceptance of neuromyths.

Discussion

Exploring avenues in which counselor educators concurrently relay accurate brain-based information while negating neuromyths is important when discussing the integration of neuroscience and professional counseling. Consistent with literature in other fields exploring the role of neuromyths (Novak-Geiger, 2023), educators with a more solid

grasp of factual neuroscience literacy play a pivotal role in reducing the likelihood of neuromyth endorsement (Dekker et al., 2012). Subsequently, this study examined if an nCBT classroom lecture that covertly challenged common neuromyths would influence the acceptance of inaccurate neuroscience knowledge of graduate students enrolled in a counseling theories course. The results reveal that students exposed to the infused nCBT lecture demonstrated a significant increase in scores on Kim and Zalaquett's (2019) neuroscience knowledge assessment, indicating a positive influence on accurate neuroscience understanding. In contrast, minimal change was observed in assessment scores for those not initially exposed to the intervention. Such significant difference in pre- and post-test scores of those who received the lecture-based intervention might indicate that exposure to accurate general neuroscience knowledge decreases the likelihood of accepting neuromyths. This finding aligns with the existing literature on the prevalence of neuromyths in education (Dekker et al., 2012; Kim & Zalaquett, 2019) and supports the efficacy of diverse educational approaches in dispelling neuromyths (Lithander et al., 2021).

The findings also underscore the importance of integrating neuro-informed knowledge into counseling education. As popularity grows in the intersection of neuroscience and counseling, evaluating the transfer of neuro-informed knowledge at the academic level becomes crucial. Current calls for increased graduate-level training in neuro-informed counseling highlight the need to address preparation and self-efficacy of clinicians in using these frameworks and modalities (Field et al., 2017; Romero et al., 2020; Russo et al., 2021). Failure to assess present educational training standards perpetuates the transmission of neuromyths, potential harm, and an overall hesitancy for integrating neuroscience concepts (Kim & Zalaquett, 2019; Wilkinson, 2018).

Implications for Counselor Education

Counselor educators and graduate programs can leverage the insights from this study to enhance their current training practices. It is imperative to align neuro-informed education with existing accreditation standards, such as those set forth by CACREP and AMHCA (AMHCA, 2023; Beeson et al., 2019; CACREP, 2023). Additionally, there is a pressing need to advocate for the ongoing evaluation and updating of accreditation standards to reflect advancements in neuroscience. Furthermore, exploring mechanisms to incentivize or mandate the integration of neuroscientific concepts into accreditation criteria can ensure that counselor education remains current and relevant. While this study focuses on neuromyths, the intervention resonates with the broader call for training avenues addressing professional counseling accrediting standards (Beeson et al., 2019; Russo et al., 2021). Integrating strategies for neuroscientific concepts supports consistent adherence to ethical standards and enhances counseling as an evidence-based discipline.

Additionally, measuring the development of neuro-informed competency during graduate programs and supervision (Field et al., 2022; Spears et al., 2024) is crucial for ensuring that counseling professionals are adequately prepared. While this study adds meaningful dialogue to existing frameworks, it is suggested that prioritizing the development of standardized tools or assessments tailored specifically to counseling education may be beneficial. These tools should be rigorously validated and widely accessible, fostering consistency and reliability in measuring the acquisition of neuroscientific knowledge and skills among counselors-in-training.

Integrating the foundations of neuro-informed approaches into the clinical course sequence (e.g., counseling skills, practicum, and internship) allows counselors-in-training to bridge theoretical understanding with clinically dynamic mental health processing and change. This addresses the conceptual complexity of neuroscience and provides practical opportunities for skill development. Expanding on practical strategies for integrating neuroscience into clinical courses, such as providing examples or case studies illustrating the application of neuroscientific principles in

therapeutic settings, is essential. Moreover, exploring innovative teaching methods, such as simulation exercises or interdisciplinary collaborations, can enrich students' understanding and application of neuro-informed approaches in clinical practice. Counselor education programs can consider establishing specialized training modules or workshops for counselor educators to enhance their understanding of neuroscientific concepts and teaching methods. Collaborating with experts in both counseling and neuroscience fields can provide valuable insights and resources for designing and implementing effective training programs. Furthermore, involving CACREP standards in the development and evaluation of these training initiatives can ensure that they meet accreditation standards and contribute to the overall quality and rigor of counselor education. By addressing these considerations, counselor education programs can better prepare their faculty to deliver high-quality neuro-informed instruction, ultimately benefiting counselors-in-training and the clients they serve. In general, by focusing on these recommendations, counselor educators, supervisors, and graduate programs can contribute to the effective integration of neuro-informed approaches, fostering a more evidence-based and ethically sound counseling practice.

Limitations and Future Research Recommendations

Several significant limitations must be considered when interpreting the results. Despite conducting data collection and participant recruitment over two semesters, our sample size remained relatively low. This factor prompted our team to maintain a power level of .80, increasing the probability of committing a Type II error. This limitation is compounded by an attrition rate of 42.59% (n = 46) between participants who completed the initial and post neuroscience knowledge assessments. This high attrition rate not only raises concerns about potential bias but also challenges the generalizability of the study results to the broader population. Further, the smaller sample size hindered the opportunity to compare the two groups empirically, preventing a robust exploration of whether observed differences are due to intentional or random variables. Counselor educators and researchers seeking to build upon this study should maintain a larger sample size, as it would facilitate a more accurate determination of generalizability, reliability, and statistical significance, and support a between-groups comparison design. Another limitation is the neuroscience knowledge assessment utilized in this study. The reliability was evaluated using Cronbach's alpha, which yielded a value of .691. While this suggests a moderate level of internal consistency, it falls slightly below the threshold of .70 for acceptable reliability. Consequently, this limitation may affect the stability of our findings and should be considered when interpreting the results. Future research may benefit from evaluating and enhancing the current neuroscience knowledge assessment to improve reliability.

Additionally, a third limitation concerns our chosen method of scoring. Following a similar structure to previous neuromyth surveys, we asked participants to rate statements as *correct*, *incorrect*, or *do not know* (Dekker et al., 2012; Kim & Zalaquett, 2019). Compared to allowing for three separate responses, a dichotomous survey of either correct/incorrect or true/false is beneficial when conducting a *t* test as the method is suitable for analyzing binary variables of group means. Dichotomous scoring also assists in minimizing the influence of additional factors and facilitates straightforward comparisons. We recommend that future neuromyth research utilizes this method of scoring when assessing normality, generalizability, and significance. Finally, our study employed both online and in-person intervention methods for delivering the lecture. We did not assess how the potential difference in teaching approaches impacted student learning, engagement, or assessment scores. To address this concern, future researchers should consider delivering the lecture in a singular format (e.g., in-person, virtual, flipped-classroom). Based on the articulated information, we offer future considerations for counselor educators and researchers interested in this study.

Given the identified limitations, we suggest that future empirical endeavors consider several additional recommendations. Following the guidance of Lithander et al. (2021), researchers should explore a pre/post/follow-up design to track the longevity of observed improvements. This design could offer insights into the sustainability of knowledge retention over time, providing a more comprehensive evaluation of the intervention's lasting impact. In addition to measuring the continuity of accurate neuroscience knowledge, future studies could delve into the foundational factors within Fields et al.'s (2022) neuroscience-informed counseling competencies training model. Researchers should examine how to integrate identified knowledge, skills, and abilities necessary for neuro-informed counselor competency. This approach would contribute to refining training practices in counselor education.

Lastly, we suggest that future researchers investigate the broader impact of integrating neuroscience and counseling on areas such as counselor identity, scope of practice, interventions, and professional development. Understanding how this integration influences various facets of professional practice can provide valuable insights for counselor educators. By addressing these recommendations, future research can build upon the current study, advancing the knowledge base on effective neuro-informed interventions in counseling education and further informing best practices for counselor educators.

Conclusion

Utilizing an nCBT framework, this research begins to address professional and ethical concerns surrounding the persistence of neuromyths (Kim & Zalaquett, 2019) and potential harm caused from inaccurate neuroscience understandings (Luke et al., 2019). Results imply that the integration of accurate neuro-informed knowledge into prepracticum counseling classes increases students' general neuroscience awareness and ability to dispel neuromyths. Further, the integration of an nCBT lecture into a counseling theories course holds significant promise for enhancing the overall quality of education in the field (Kim & Zalaquett, 2019). Embracing a neuroscientific perspective not only aligns with contemporary research advancements specific to mental health but also empowers excellence in counselor education and promotes the efficacious therapeutic modalities offered to clients.

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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The authors reported no financial support for the research, authorship, and/or publication of this article.

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How to Cite This Article:

Spears, J. R., Villalobos, N., Zahar-Rich, W., Prasath, P. R., & Ray, W. (2025). Exploring neuromyths in counselor education: A neuro-informed cognitive behavioral therapy approach. *Teaching and Supervision in Counseling, 7*(1), 28-40. https://doi.org/10.7290/tsc07jkay