

Neuroscience-Informed Technology: Implications for Professional Counselors and Counselor Education

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Abstract

The ACA Code of Ethics (2014) state that counselors who use technology must also develop the knowledge and skills necessary to safely engage with clients. To date, no studies were found that identified prevalence or preferences among counselors' use of technology with clients. The purpose of this pilot study was to investigate licensed professional counselors' self-assessment of competency to use Neuroscience-Informed Technology (NIT). A national sample of licensed professional counselors were surveyed (N = 69). Results indicate that licensed professional counselors feel competent to use NIT as an intervention in their clinical work (94%). Participants reported feeling most competent in their use of NIT mobile applications as a clinical intervention (88%), followed by video (70%), and equipment (15%). Implications for the findings are explored and recommendations for future research are provided.

Keywords

neuroscience, technology, counseling

Over the last two decades, the world has undergone a digital revolution that continues to evolve and expand (Bucci et al., 2019). Digital advancements have created numerous opportunities within the nature and delivery of counseling services, including the development of web-based interventions, psychoeducation, and digital counseling platforms (Woo et al., 2020). Rebello et al., (2014) consumer technology demonstrated the potential for "building clinical capacity and expanding mental health coverage; integration of mental health service in primary care; expanding human capacity through task sharing and training; and innovative use of technological platforms to enhance access, cut costs, and reduce stigma" (p. 308). Living in a "digital age", many countries have normalized the presence and implementation of technologies.

Mental health professionals can take advantage of the mass uptake in smartphone ownership and usage to address client's mental health concerns (Bucci et al., 2018). The use of web-based interventions (i.e., mobile devices, social media, virtual reality) provides supplemental materials to clients in the form of audio, video, and/or animations, as opposed to a more traditional, text-based model (i.e., worksheets) (Mohr et al.,

2013). Clients may increase their participation in treatment interventions that can be integrated into their daily lives such as smartphone applications, smartwatches, and other fitness and health monitoring devices. Mobile technologies (i.e., apps) can be used by clients daily or in between sessions to provide short term benefits and skill building for symptoms related to anxiety, eating disorders, bipolar disorder, medication compliance, depression, and schizophrenia (Kazdin, 2015; Mohr et al., 2013). Additionally, technology-based interventions can be used for client self-assessment and monitoring, psychoeducation, and skill development (Mohr et al., 2013).

Neuroscience-Informed Technology (NIT)

Neuroscience-Informed Technology refers to the combination of technology and neuroscience-informed counseling (Luke, 2019). The current investigation used the term "neuroscience-informed counseling" to refer to the act of integrating neurological aspects of various mental health symptoms and disorders into the practice of counseling (Luke, 2020). Neuroscience-informed counseling therefore can be used as an adjunct to a counselor's therapeutic approach. For example, a neuroscience-informed counselor might

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talk to a client about neuroplasticity and neurogenesis while supporting them to develop new coping strategies (Luke, 2020). Knowledge about neuroscience can provide concrete evidence that change is possible.

In the current study, NIT was defined as a method of neuroscience-informed counseling that uses technology as an intervention to help clients gain awareness of their neurological processes. Examples of NIT include, but are not limited to, mobile applications that increase a client's neural processing abilities (e.g., apps focused on mindfulness, journaling), videos that provide clients with neuroeducation (Miller & Beeson, 2020) about their brains systems, structures, and functions (e.g., YouTube, TED Talks) can be forms of NIT, and NIT equipment that provides the client with information about their neurological and physiological responses during periods of stress, anxiety, etc. (e.g., neurofeedback, biofeedback equipment, smart watches).

With the growing number of technologies available (i.e. apps, video, equipment), counselors may find it difficult to integrate NIT into practice in a competent and ethical manner. Questions regarding ethical use have arisen as more "digital natives" enter the profession of counseling and NIT has increased. The 2014 American Counseling Association (ACA) Code of Ethics was the first to include an entire section (Section H) focused on technology. This update to the ACA Code was, in part, due to the increasing and undeniable presence of technology's use in the counseling profession (Kaplan et al., 2017). The ACA Code (2014) states that, "Counselors who engage in the use of distance counseling, technology, and or social media develop knowledge and skills regarding related technical, ethical, and legal considerations" (H.1.a, p. 17).

Although this standard specifically addresses technology competency, it leaves a lot of unanswered questions for technology-based interventions. For instance, how much technical, ethical, and legal consideration would be considered best practice for recommending a mindfulness app to a client? Neurofeedback, once inaccessible due to price, can now be purchased for a few hundred dollars, with no mental health credentials, and synched via Bluetooth to a cell phone. What is the minimum level of competency for a counselor to use these interventions in session? If a counselor feels competent to use a selected piece of technology (i.e. they know how to download and use a mindfulness app), how do they determine if they are competent with the content (i.e., have they received mindfulness training)? In other words, although there is empirical evidence documenting the growth of technology within the counseling profession, there remains a lack of scholarly literature discussing counselor training and preparation to use technology as an interven-

tion in their clinical work (Lustgarten & Elhai, 2018).

Purpose of Study

The purpose of this pilot study was to investigate licensed professional counselors' self-assessment of competency to use Neuroscience-Informed Technology (NIT). The following research questions were used: (a) What are the characteristics of licensed professional counselors who use NIT personally and professionally? (b) What neuroscience-informed technologies are licensed professional counselors using with clients? (c) What are licensed professional counselors' perceptions of their competency to use NIT personally and professionally?

Method

Following IRB approval, this survey study recruited counselors and counselor educators via listservs using a Qualtrics survey. Participants were recruited through convenience and snowball sampling to generate as many responses as possible.

Participants

Participants represented a cross section of counselors who work in settings like community outpatient clinics ($n = 18$), schools ($n = 10$), private practice clinics ($n = 9$), and universities ($n = 11$). Sixty-two percent ($n = 43$) of participants identified as female. Half ($n = 34$) of all participants were under the age of 54, 15% ($n = 10$) between the ages of 55 and 64, and 17% ($n = 12$) were 65 years of age or over. Only 3 participants identified as non-white. Most participants had achieved licensure (80%), with 44% ($n = 30$) of participants having been licensed for less than 10 years. Most participants worked as a counselor in a clinical or school setting (58%). Additional demographic details can be found in Table 1.

Measure

The first author developed a web-based questionnaire, The Neuroscience-Informed Technology Usage Questionnaire (NITUQ), that was subsequently piloted by members of the research team. The team included a faculty member at a CACREP-accredited counselor education program in the United States who served as a neuroscience content expert. The NITUQ was also piloted by a faculty member at a CACREP-accredited counselor education program in the United States who served as a statistician to verify the questionnaires content analysis for accuracy. Feedback was provided by research team members on the survey questions and incorporated into the survey. Questionnaire items were developed according to Fowler's (2013) guidelines. The survey consisted of 37 items which focused on both counselors' personal and professional use of neuroscience informed technology. The NITUQ included

Table 1			
<i>Participant's Demographic Information</i>			
Demographic Variable	<i>n</i>	Do not use NIT as Intervention (<i>n</i> =15)	Use NIT as Intervention (<i>n</i> =54)
NIT Personal	69	7 (47%)	51 (94%)
Gender	69		
Male		7 (47%)	19 (35%)
Female		8 (53%)	35 (65%)
Age	56		
25 - 34		3 (23%)	9 (21%)
35 - 44		2 (15%)	12 (28%)
45 - 54		2 (15%)	6 (14%)
55 - 64		2 (15%)	8 (19%)
65+		4 (27%)	8 (19%)
Unknown		2	11
Obtained Professional License	69	12 (80%)	35 (65%)
Years since licensure	54		
0 - 4		5 (38%)	17 (41%)
5 - 9		2 (15%)	6 (15%)
10 - 14		3 (23%)	6 (15%)
15 - 19		0 (0%)	2 (4.9%)
20 - 24		3 (23%)	4 (9.8%)
25 - 29		0 (0%)	3 (7.3%)
30+		0 (0%)	3 (7.3%)
Unknown		2	13
What is your current primary job function?	56		
Counselor		10 (77%)	30 (70%)
University Faculty Member		3 (23%)	5 (12%)
Other		0 (0%)	8 (19%)
Unknown		2	11
What is your primary work setting?	56		
Community (Residential)		0 (0%)	6 (14%)
University (Clinical)		1 (7.7%)	2 (4.7%)
Inpatient Hospital		0 (0%)	1 (2.3%)
School		5 (38%)	5 (12%)
Community Outpatient		2 (15%)	16 (37%)
University Full-time or Part-time Faculty		2 (15%)	6 (14%)
Other		0 (0%)	1 (2.3%)
Private Practice		3 (23%)	6 (14%)
Unknown		2	11

questions about mobile applications (e.g., Mindfulness apps., Journaling apps., Anxiety reduction apps) web videos (e.g., Psychotherapy.net, YouTube, TED Talks) and neuroscience informed technology equipment (e.g., fMRI, neurofeedback equipment, biofeedback equipment). Mobile apps were considered neuroscience-informed if they could be used in session to build a client's neurological self-awareness. Like mobile applications, neuroscience-informed video content was defined as content counselors could watch or recommend to clients regarding the specific neuroscience of their mental health concerns. The final type of neuroscience-informed technology identified in this study was equipment-based technology. Each set of technology questions included space for respondents to enter free text if their choice of technology was not listed.

The survey asked respondents about their personal and professional use of neuroscience-informed technology. Respondents indicated whether or not they had used any neuroscience-informed technology for personal benefit or as an intervention with clients, indicated which type of technology (application, video, or equipment) they used, estimated how often they used each technology in a given month on a scale from 0 ("Not at all") to 30 ("All the time"), rated their agreement that the technologies are useful for personal benefit or as interventions on a scale from 1 ("Strongly Disagree") to 5 ("Strongly Agree"), and rated their agreement that they were competent to use the technologies in counseling on a scale from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). Following the survey section about their use of NIT, respondents provided demographic information including gender identity, race, location, licensure status and years licensed, primary job role, and primary setting.

Procedure

After piloting the survey and obtaining IRB approval, the survey was distributed using the BrainstormLive, the American Counseling Association's Neuroscience Interest Network (NIN), the CESNET-L listserv, and the Tennessee Licensed Professional Counselor listserv. Data were collected between September 2018 and March 2019 (pre-COVID-19) with an initial goal of 200 participants. No response rate is available due to the use of listservs and organizational email lists often having overlapping member lists.

Data Analysis

Following data collection, data were exported from Qualtrics and cleaned and inspected for errors or outliers. The authors used exploratory data analysis to evaluate each of the research questions. To explore the first research question, univariate statistics were calculated for both the entire sample and for groups

based on the use of NIT interventions. A Chi-Square test of Homogeneity was used to compare the distribution of gender identity, age, years of licensure, job role, and primary work setting. The second research question was answered through univariate analyses of types of technology counselors used and the frequency of their use. Finally, Spearman's rank order correlations were used to inspect the relationships between participants ratings of the frequency, utility, and perceived competency for personal and professional use of NIT.

Results

Professional Counselors Who use NIT

Univariate analyses allowed for extensive descriptive statistics about the participants who completed the survey. Across all participants, 78% ($n = 54$) reported using some form of NIT as an intervention in their counseling practice. Counselors who use NIT for intervention tend to have been licensed fewer than 10 years (42%), are younger than 45 years old (39%), and are female (65%). These counselors report primarily working as a counselor (70%) in a community outpatient (37%), private practice (14%), community residential (14%), or university (14%) setting.

Overall, of the participants who endorsed using NIT as a counseling intervention, 94% ($n = 51$) reported using NIT for personal benefit as well. By contrast, only 47% ($n = 7$) of the participants who reported not using NIT as an intervention reported using it for personal benefit. Chi-square tests of homogeneity suggest that there is no demographic difference between counselors who use NIT interventions and counselors who do not. This result is consistent across gender identity, $\chi^2(1, n = 69) = 0.26, p = .61$; age categories, $\chi^2(4, n = 56) = 1.41, p = .84$; years of licensure, $\chi^2(6, n = 54) = 4.34, p = .63$; primary job role, $\chi^2(2, n = 56) = 3.41, p = .18$; and primary work setting, $\chi^2(7, n = 56) = 8.63, p = .28$ (see Table 1).

Neuroscience-Informed Technology in the Counseling Room

Participants reported using each of the technologies covered in the survey. Mobile phone applications were the most common, with 88% ($n = 48$) of participants reporting some use of these applications as interventions. Mindfulness applications were the most used type of application, with 77% ($n = 42$) of participants having used one or more, while journaling applications (35%) and anxiety reduction applications (55%) receiving less use. Ten participants reporting using another application which was not included on the survey, including mood trackers, language acquisition applications, and guided meditations applications. Neuroscience informed videos were used by nearly as many respondents, with 70% ($n = 38$) reporting that they had used these videos

as an intervention during counseling. YouTube (59%) and TEDTalks (44%) were the most common sources for videos, with few participants indicating alternative sources. Participants specified using Dan Siegel and Tara Branch videos, as well. Finally, very few participants reported any use of NIT equipment, with only 15% ($n = 8$) having used any as an intervention. Biofeedback equipment was the most common (9.3%) (see Table 2)

Neuroscience-Informed Technology	n (%) ¹	
NeuroInformed Application	48 (88%)	
Mindfulness Application		42 (77%)
Journaling Application		19 (35%)
Anxiety Reduction Application		30 (55%)
Neuroscience Informed Application		13 (24%)
Other NeuroInformed Application		10 (19%)
NeuroInformed Videos	38 (70%)	
Youtube		32 (59%)
TED		24 (44%)
Psychotherapy.net		4 (7%)
Other Videos		4 (7%)
NeuroInformed Equipment	8 (15%)	
Biofeedback Equipment		5 (9.3%)
Neurofeedback Equipment		2 (4%)
fMRI Equipment		0 (0%)
Other Equipment use		2 (4%)

¹N = 54

Counselor Ratings of NIT Utility, Perceived Competence, and Frequency of Use

The survey asked participants to rate the usefulness of each type of NIT for both personal use and as an intervention, and their competence in using this technology as an intervention. Eighty-four percent ($n = 55$) of participants agreed or strongly agreed that NIT mobile applications were personally useful, and 75% ($n = 49$) of participants agreed or strongly agreed that NIT mobile applications were useful as interventions. Most participants (72%) felt competent to use mobile applications as an intervention. Eighty-one percent ($n = 53$) of participants agreed or strongly agreed that NIT web videos were personally useful, and 58% ($n = 38$) of participants agreed or strongly agreed that NIT web videos were useful as interventions. Again, most participants (69%) felt competent to use web videos as a counseling intervention. Thirty-four percent ($n = 22$) of participants agreed or strongly agreed that NIT equipment was personally useful, and 40% ($n = 26$) of participants agreed or strongly agreed that NIT equipment was useful as in-

terventions. A sizable portion of participants felt neutral on the utility of NIT equipment for personal (44%) or intervention (41%) use. In this situation, most participants either felt neutral (25%) or did not feel competent (42%) to use NIT equipment as a counseling intervention.

There was a statistically significant correlation between personal and interventional usefulness for mobile applications, $r_s = .62, p < .001$; web videos, $r_s = .49, p < .001$; and for NIT equipment, $r_s = .70, p < .001$. Similarly, there was a strong correlation between participants perceived competence for a type of technology and reported it to be useful as an intervention for mobile applications, $r_s = .53, p < .001$ and web videos, $r_s = .63, p < .001$; but not for NIT equipment, $r_s = .12, p = .40$. Finally, there was a strong correlation between how useful participants found mobile applications and web videos as counseling interventions, $r_s = .67, p < .001$, a moderate correlation between how useful web videos and NIT equipment as counseling interventions, $r_s = .27, p < .043$, and a moderate but not statistically significant correlation between how useful mobile applications and NIT equipment for counseling interventions, $r_s = .24, p < .078$.

Participants reported the frequency over the last month for both personal and professional use of mobile applications, web videos, and NIT equipment. For mobile applications, participants reported an average of 2.3 ($SD = 2.07$) times for personal use and 4.0 ($SD = 3.41$) times for intervention use per month. Web videos were used with a frequency of 1.1 ($SD = .78$) times per month for personal use and 3.1 ($SD = 1.94$) times as intervention per month. For those that used NIT equipment, they reported using this technology 2.5 ($SD = .99$) times per month personally and 3.0 ($SD = 1.56$) per month as an intervention. More frequent personal use was correlated with greater feelings of competence for mobile applications, $r_s = .32, p = .008$, but not for any other technology. There were no correlations of note between more frequent interventional use and competence. More frequent personal use of mobile applications was also correlated with more frequent interventional use, $r_s = .43, p < .001$, but no similar correlation was found for the other NITs.

Discussion

Smart technology (i.e., smart phones, smart watches, smart homes) have become integrated into our everyday human experience. It can be easy to forget its existence as it has become so embedded in seemingly every facet of our lives. The current pilot study investigated licensed professional counselors' self-assessment of competency to use Neuroscience-Informed Technology (NIT). NIT was defined as the integration of technology into counseling practices to help clients gain a better understanding of their biological and physiological

symptoms. Results of the current pilot study indicate that counselors, across age groups, experience-levels, roles, and settings, are using NIT both in their personal lives and as an intervention in their clinical work.

Of the three types of NIT studied (i.e., mobile apps, videos, and equipment), counselors reported using mobile apps with the most frequency. This may be due to the convenience, affordability, and availability of mobile applications for counselors and clients in today's digital age. Interestingly, this may also be a result of counselor's personal use and familiarity with mobile applications in their lives. Putting a cell phone in ones' pocket or handbag is as normal as putting on shoes to go outside. It may seem like second nature to integrate this useful tool into counseling practice as an intervention.

Participants in this study reported that those who used NIT more frequently in their personal lives, felt competent to use NIT as an intervention with clients. However, counselors have an ethical responsibility to be competent in the interventions they use. Walfish (2012) investigated counselors' self-assessment of their clinical ability and found that counselors often are biased in their assessment of their own performance and client outcomes. Although personal experience is a contributing factor to ones' perceived competency level, counselor may be biased in their competency regarding their own skills. Emerging research into the use of neuroscience-informed counseling, supports that it is easy for counselors to exceed their scope of practice and even the role of counselor (Luke et al., 2020).

Mobile applications and web videos were reported as useful by participants for both personal and professional consumption, while they were neutral on the utility of NIT equipment. This may be due to the growing availability and popularity, and variety of NIT apps and video content available today (Chiauzzi & Newell, 2019; Layne & Hohenshil, 2005). It is also worth noting that Mindfulness and Journaling apps were the most used NIT apps by respondents in their clinical work. Participants reported that YouTube and TedTalk videos are the most used video content. This may be due to scholarly research indicating the benefits of using mindfulness and journaling as clinical interventions (Baer, 2003; Howells et al., 2016). This may also indicate a need for more formalized education surrounding the ethical use of mindfulness and journaling apps in particular.

Limitations

One of the limitations inherent in a pilot study is the use of survey items that may not have been normed prior to use. The exploratory nature of this study, however, permitted the design of the survey for gathering preliminary data on NIT, since no literature on its specific use was found. Another limitation of this study was a relatively small sample size, which limited the power

of the analyses. In this case, the absence of statistical significance among many variables may be due to the low N, though this cannot be known with certainty. The use of listservs for participant recruitment is limited in that it prevents computing response rate; in addition, while the researchers only included licensed counselors, only those interested in participating in this type of study may have completed the survey, potentially resulting in less diverse sample. Lastly, there was an overrepresentation of White, female participants, which limits the generalizability of the findings to other groups.

Implications and Directions for Future Research

Professional Counselors

The excitement around neuroscience is palpable and growing. Like many areas of rapid expansion, enthusiasm for neuroscience-related interventions can outpace ethical practice (Luke et al., 2020). Lustgarten and Elhai (2018) noted specific areas for counselors to consider when adopting new technology into their clinical work such as receiving appropriate training and an undertraining of applicable laws and ethical codes. ACA's current Ethical codes address technology in regards to distance counseling, technology assisted services, record keeping, and social media, but must expand to include counselor's use of technology as a clinical intervention (i.e., apps, videos, equipment).

It is essential that counselors' process their beliefs and biases regarding the usefulness of NIT in session so as not to impose them on that of their clients. For instance, a client could feel judged by a counselor encouraging them to use mobile applications when they don't feel comfortable and/or have access to the technology. Workshops regarding ethics and cultural sensitivity particularly pertaining to the use of NIT as an intervention should be developed for professional counselors.

Similarly, workshops focused on mindfulness or journaling applications as clinical interventions can include components specifically related to how these established interventions can be used with clients via technology. For instance, attending an established seven-week training on mindfulness-based stress reduction (cite) can include information on how to use mobile applications (e.g., Calm, Headspace) with clients.

Counselor Education

Counselor educators can integrate NIT components into graduate students' coursework (Duenvas & Luke, 2019). For example, discussing ethical concerns related to using NIT as an intervention can be discussed in an Professional Ethics course. Along the same lines, neuroscience-informed counseling courses can include a component on different types of NIT and process

student's self-awareness surrounding their perceived level of technology competency (Duenyas & Luke, 2019). Research suggests that individuals who are less competent to perform a task are most susceptible to misrepresenting their ability (Walfish, 2012), therefore providing opportunities for counselors to not only learn, but practice using technology as a counseling intervention can help to build counselor competence.

Future research and scholarly literature should investigate the use of technology as an intervention. Participants in the current study predominantly identified as White/Caucasian, thus future studies need to be conducted with a more diverse sample to examine the NIT experiences of counselors with different cultural identities. The current study was a pilot study due to a low N and more participants would help to improve the findings generalizability. Finally, results of this study indicated that counselors use technology in their clinical work. Future studies could explore counselors training and preparation to use NIT as a clinical intervention.

Conclusion

Technology and neuroscience-informed counseling are growing fields of inquiry in the counseling profession. The results of the current study indicate that counselors are using Neuroscience-Informed Technology (NIT) in both their personal and professional lives. Research has indicated that counselors may be overzealous when reporting their clinical competencies and the ease of using NIT in session is one area that could be overlooked. Professional counselors and counselor educators must be vigilant to receive appropriate training for technological interventions and to not overestimate their ability when using NIT in practice.

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