



Historical and Contemporary Synopsis of the Development of Field Education Guidelines in BSW, MSW and Doctoral Programs

Journal:	Professional Development: The International Journal of Continuing Social Work Education
Article Title:	<i>Social Workers as Professionals and Citizens: The Case of Governance of Neuroscientific and Neurotechnological Advancements</i>
Author(s):	<i>Djebrouni and Wolbring</i>
Volume and Issue Number:	<i>Vol.23 No.2</i>
Manuscript ID:	232022
Page Number:	22
Year:	2020

Professional Development: The International Journal of Continuing Social Work Education is a refereed journal concerned with publishing scholarly and relevant articles on continuing education, professional development, and training in the field of social welfare. The aims of the journal are to advance the science of professional development and continuing social work education, to foster understanding among educators, practitioners, and researchers, and to promote discussion that represents a broad spectrum of interests in the field. The opinions expressed in this journal are solely those of the contributors and do not necessarily reflect the policy positions of The University of Texas at Austin's Steve Hicks School of Social Work.

Professional Development: The International Journal of Continuing Social Work Education is published two times a year (Spring and Winter) by the Center for Social and Behavioral Research at 1923 San Jacinto, D3500 Austin, TX 78712. Our website at www.profdevjournal.org contains additional information regarding submission of publications and subscriptions.

Copyright © by The University of Texas at Austin's Steve Hicks School of Social Work. All rights reserved.
Printed in the U.S.A.

ISSN: 1097-4911

URL: www.profdevjournal.org

Email: www.profdevjournal.org/contact

Social Workers as Professionals and Citizens: The case of Governance of Neuroscientific and Neurotechnological Advancements

Djebrouni and Wolbring

Abstract

We conducted semi-structured interviews with ten social workers to explore the role of social workers as professionals and active citizens in the discussions surrounding ethical, legal, and social (ELS) implications of neuroadvancements. Additionally, we sought to investigate the utility of lifelong learning as a mechanism that can be used to gain knowledge about ELS issues of neuroadvancements. We found that participants were not involved in ELS discussions of neuroadvancements, and lifelong learning was not used to learn about their implications. Social workers can enrich the ELS discussions of neuroadvancements. Education could be used as a tool to entice social workers to partake in these discussions.

Introduction

Neuroscientific and neurotechnological advancements (NA), one sub-area of scientific and technological advancements, increasingly impact social work practice (Farmer, 2008; Johnson, 2001; Matto & Strolin-Goltzman, 2010; Shapiro & Applegate, 2000; Wolbring & Diep, 2014). Social workers, social work clients, and social work practice can be impacted by NA in various ways, including:

- a) as potential non-therapeutic users (consumer)
- b) as potential non-therapeutic users (client educator and educator of public)
- c) as potential therapeutic users (professional practice, client use)
- d) as potential therapeutic users (professional practice, client educator and educator of public)
- e) by changing societal parameters caused by humans using NA, impacting the social worker as citizen (military, changes in how humans interact, employer using it in the workplace...)
- f) by changing societal parameters caused by

humans using NA, impacting the client of social worker (military, changes in how humans interact, employer using it in the workplace...)

- g) by changing societal parameters caused by humans using NA, impacting social work practice (military, changes in how humans interact, employer using it in the workplace...)

Social workers have responsibilities as professionals and as citizens (Burns, 1947). Integrating social work and neuro-related research is important to understand a range of social problems (Eack et al., 2018). Lifelong learning could be used as a mechanism to learn about social, ethical, and legal issues raised by NA on a continuous and anticipatory level. This, in turn, could empower social workers to actively contribute to the neuroethics and neuro-governance discussions in their role as professionals and citizens, and as such, be moral actors as argued for by (Bell et al., 2016) and as discussed extensively in the social work literature (Chu et al., 2009; Stanford, 2011).

Given the impact of NA on social work clients, practitioners, and practice; the potential utility of lifelong learning; the role expectation of social workers as professionals and as citizens; and given the literature that indicates that social work is not really present in the ethical, social, and legal discussions around NA (Bell et al., 2016; Bell & Racine, 2013; Wolbring & Diep, 2014), the purpose of this paper was to answer three research questions: a) what is the familiarity of social workers with neurotechnology's and their ethical, legal, and social implications; b) what are the lifelong learning mechanisms put in place for social workers, and their utility and limitation as it pertains to learning about neurotechnology, especially the ethical, legal and social implications; and c) what is the involvement of social workers as professionals and as citizens in the neuro-ethics and neuro-governance discourses?

Manel Djebrouni, BCR, is at the University of Calgary

Gregor Wolbring, PhD, is an Associate Professor at the University of Calgary's Cumming School of Medicine

Social Work

The Global Definition of the Social Work Profession approved by the International Federation of Social Workers (IFSW) General Meeting and the International Association of Schools of Social Work (IASSW) General Assembly in July 2014 is the following:

Social work is a practice-based profession and an academic discipline that promotes social change and development, social cohesion, and the empowerment and liberation of people. Principles of social justice, human rights, collective responsibility and respect for diversities are central to social work. Underpinned by theories of social work, social sciences, humanities and indigenous knowledge, social work engages people and structures to address life challenges and enhance wellbeing (International Federation of Social Workers (IFSW), 2016, p. para.1). In the commentary it is further stated:

The social change mandate is based on the premise that social work intervention takes place when the current situation, be this at the level of the person, family, small group, community or society, is deemed to be in need of change and development. It is driven by the need to challenge and change those structural conditions that contribute to marginalization, social exclusion and oppression (International Federation of Social Workers (IFSW), 2016, pp. Core Mandates, para.3).

Using even stronger language, it is stated that “advocating and upholding human rights and social justice is the motivation and justification for social work” (International Federation of Social Workers (IFSW), 2016, pp. Principles, para.2). The basic goal of social work is to facilitate social wellbeing and social functioning of the person in their environment and advance principles of social justice (Canadian Association of Social Workers, 2017b). Many other key aspects of social work that are of relevance to this study can be found in different statements of the IFSW covering women (IFSW, 2012g), displaced persons (IFSW, 2012b), human rights (IFSW, 2012f), globalization and the environment (IFSW, 2012d), ageing and older adults (IFSW, 2012a), health (IFSW, 2012e), global standards (IFSW, 2012c), and people with disabilities (International Federation of Social Workers IFSW, 2012), human dignity (Canadian Association of Social Workers, 2017b), 10th edition of the National Association of Social Workers (USA;NASW) Policy Statements

(NASW Press, 2015), and the global social agenda (Wolbring & Diep, 2014).

The Canadian Association of Social Workers (CASW) lists many roles that social workers ought to have in general and in relation to specific work profiles (CASW, 2009). For example, for social workers involved in physical rehabilitation, the roles expected include advocate on an individual and systemic level, researcher, educator of students and community groups, and learner (CASW, 2009).

Social workers are “to maintain a critical attitude towards the problem with which he is working” (Buell (1926, p. 742), and it is argued that “specific goals to which social workers are devoted are jeopardized if we are passive on the larger social issues of our day” (Burns (1947, p. 37). It is also argued that social workers have not only responsibilities as professionals, but also as citizens (Burns, 1947). That social workers have responsibilities as citizens fits with; a) the understanding of an active citizen as someone who “participates in the life of the community in order to improve conditions for others or to help shape the community’s future”, and b) that civic engagement is “oriented towards social change or the betterment of the lives of community members and being concerned with shaping the society that we want to live in” (Harris and Roose (2014, p. 795). Active citizenship focuses on whether and how people participate in all spheres of social and economic life, the chances and risks they face in trying to do so, and the extent to which they therefore feel that they belong to and have a fair say in the society in which they live (Field & Schemmann, 2017). Professional commitment to social action and social change is expressed in the Canadian Code of Social Work Ethics (Hardina, 1994) and is discussed for a long time (Belchior Rocha, 2018; Dickinson, 2004; Hardina, 1994; Lee, 2009; Lister, 1998; Pray, 1945; Social Work Action Network, 2010; Thursz, 1966). It is argued that “we should teach future professionals to understand and practice their professional competence not only in terms of expertise but equally in terms of competent citizenship. Thus, only that professional will be considered a competent professional who also is a competent citizen” (Ulrich, 2003, p. para. 8). Social work schools in Canada seek to fulfill the goals of social work and the role expectations of social work and social workers as outlined by Canadian Association of Social Workers. They aim to do so by providing social work education, conducting

scholarly inquiry, disseminating knowledge, and contributing to public policy and practice (Memorial University School of Social Work, 2015). And through curricula, scholarship, and creating school culture conducive to promoting the aims of social work (Dalhousie University School of Social Work, 2015).

Social Work and Neuroscientific and Neurotechnological Advancements (NA)

Advancements in science and technology constantly impact social work (Csiernik et al., 2006; Houston, 2001; Wolbring & Diep, 2014). NA are one sub-area increasingly impacting social work practice (Farmer, 2008; Johnson, 2001; Matto & Strolin-Goltzman, 2010; Shapiro & Applegate, 2000). We posit that social workers and social work practice can be impacted by NA in various ways:

- a) as potential non-therapeutic users (consumer)
- b) as potential non-therapeutic users (client educator and educator of public)
- c) as potential therapeutic users (professional practice, client use)
- d) as potential therapeutic users (professional practice, client educator and educator of public)
- e) by changing societal parameters caused by humans using NA, impacting the social worker as citizen (military, changes in how humans interact, employer using it in the workplace...)
- f) by changing societal parameters caused by humans using NA, impacting the client of social worker (military, changes in how humans interact, employer using it in the workplace...)
- g) by changing societal parameters caused by humans using NA, impacting social work practice (military, changes in how humans interact, employer using it in the workplace...)

Furthermore, NA impact most, if not all, roles expected from social workers, such as being an advocate on an individual and systemic level, researcher, educator of students and community groups, and learner.

Integrating social work and neuroscience research is seen as important to understand a range of social problems (Eack et al., 2018). Neuroscience could enhance the ability of social work to increase “social justice and improve the welfare of children and youth, families, and

communities” (Black & Conway, 2018, p. 262). It could also provide information about the effectiveness of social work interventions (Black & Conway, 2018).

Social work’s attention to marginalized and disenfranchised populations provides a much needed pathway to direct neuroscience research toward more diverse and representative participant samples, community voice and collaboration, and a foundation of culturally grounded methodology, including aims, hypotheses, interventions, and translation to practice (Black & Conway, 2018, p. 262).

To incorporate neuroscience knowledge into social work education on the graduate and undergraduate level is also flagged as important (Black & Conway, 2018; Egan et al., 2011; Johnson, 2001; Montgomery, 2013; Wojtalik et al., 2018; Yorke & Bergère, 2018). NA are impacting social work areas of inquiry such as empathy (Gerdes, Lietz, et al., 2011; Gerdes, Segal, et al., 2011), resilience (Hunter et al., 2018), and work with children and adolescents (Black & Conway, 2018).

Virtual reality (Trahan et al., 2019), neurosciences (Black & Conway, 2018; Wojtalik et al., 2018) bionic eyes (Ashworth, 2018), cognitive stimulation (Yates et al., 2017), electro-encephalogram (EEG) (Garland & Howard, 2018), neurofeedback (McMahon, 2015; Stankus, 2008), deep brain stimulation (DBS) (Bell et al., 2016; Bell et al., 2009; Hack et al., 2015), cognitive enhancement (Eack, 2012), brain imaging (Gerdes et al., 2010; Page et al., 2012), and cochlear implants (Pray & Jordan, 2010) are some neurotechnology mentioned in relation to social work. At the same time Bell, Leger, Sankar, and Racine (2016) in their article “Deep Brain Stimulation as Clinical Innovation: An Ethical and Organizational Framework to Sustain Deliberations About Psychiatric Deep Brain Stimulation,” make the case by citing (Bell & Racine, 2013), saying “trainees from diverse healthcare professions (e.g., nursing, social work, physiotherapy) are not well prepared to handle many of the ethical issues associated with psychiatric DBS because, among other reasons, they may be unprepared to engage in ethical reflection, they have a limited understanding of issues associated with scientific uncertainty, and they may lack an interdisciplinary understanding about ethical issues” (Bell et al., 2016, p. 6).

Additionally, the case is made that social work academic literature is not visible in many science and technology governance discussions and in discourses around robots, brain machine interfaces, and neuroenhancements (Wolbring & Diep, 2014).

Governance of Emerging Neurotechnology and Social Work

How to govern scientific and technological advancements has been debated for some time (Carraz, 2012; Irwin, 2008; Macnaghten et al., 2005; Todt, 2011; Wolbring, 2010, 2012a). Neuroethics was coined as a term, and developed as a field, to investigate various ethical, social, and legal issues raised by NA (Farah, 2005; Levy, 2008; Roskies, 2002). Neuroethics and neurotechnology governance consider the ethical issues for the neuro-field as a whole, and in relation to individual neuro-applications such as brain computer interfaces (Clausen, 2011; Nijboer et al., 2013) or deep brain stimulation (Bell et al., 2016). It has been agreed upon that ethical, legal, and social implications should inform the trajectory of NA whereby many stakeholders have been identified, including health professionals (Garden & Winickoff, 2018) and citizens (Stahl et al., 2016).

The social work discipline utilizes a variety of principles such as empowerment, engagement, inclusion, social justice, anti-oppression, and anti-colonialism (Barton, 1997; Carter, 2004; Dos Santos, 2009; Hodson, 1999; Pozzer & Jackson, 2015; Tobin, 2009) that suggest that social workers have a stake in the NA discussions. Social workers can contribute to the governance discussions as part of their social worker identity, but also under the identity of being an active citizen. The professional ethics of a social worker is based on moral citizenship that includes social consciousness and social conscience. The social worker's awareness, action, feeling, and thinking are major elements of the framework of moral citizenship. This framework could help social workers in dealing with contemporary ethical problems related to their profession to help them initiate social transformations integrated with social values (Manning, 1997).

Today, social workers face the challenges of the most complex ethical dilemmas in the history of the profession. Contemporary changes in postmodern society have brought forth ethical

dilemmas in all areas of practice. However, social workers could shape these transformations through their work. This article discusses a framework for thinking about and taking action about the ethical dilemmas in social work practice through moral citizenship (Manning, 1997).

Lifelong Learning Mechanisms

The concept of lifelong learning (LL) has a long history (Vidmar, 2014) and is referred to in most academic and political spheres in terms of the future of society and the role professionals play in this future (Webster-Wright, 2009). LL is a deliberate form of acquiring new knowledge throughout a person's lifetime (Knapper & Cropley, 2000). All professionals and stakeholders have the responsibility to maintain high quality practice, which they achieve through professional development mechanisms (Webster-Wright, 2009). Current LL practices have a large emphasis on evidence-based practice and ensuring positive outcomes for clients or patients (Garet et al., 2001; Penz & Bassendowski, 2006; Webster-Wright, 2009). LL is about learning to know, learning to do, learning to live together, and learning to be (Vidmar, 2014). Active citizenship is increasingly being framed in the context of lifelong and life-wide learning (Field & Schemmann, 2017; Li, 2017; Lucio-Villegas, 2014; Mikelatou & Arvanitis, 2018; Vidmar, 2014).

LL is a cornerstone of the social work professions (Canadian Association for Social Work Education, 2015; Canadian Association of Social Workers, 2005, 2017a).

LL could be a mechanism to: a) learn about neuro-technologies (NTs) and their ethical, legal and social implication (ELS) on a continuous and anticipatory level, b) to empower practitioners to not only be passive recipients of knowledge but to actively contribute to the NT governance discussions, and c) to be moral actors as argued for by (Bell et al., 2016) and as discussed extensively in the social work literature (Chu et al., 2009; Stanford, 2011).

This study investigated three research questions: a) What is the familiarity of social workers with neuro-technologies and their ethical, legal, and social implications; b) What are the lifelong learning mechanisms put in place for social workers, and their utility and limitations as it pertains to learning about neuro-technologies,

especially the ethical, legal, and social implications; and c) What is the involvement of social workers as professionals and as citizens in the neuroethics and neurogovernance discourses?

Method

Study Design

The study design for this project was one of qualitative exploration (Braun & Clarke, 2013) using semi-structured interviews to answer three research questions: a) What is the familiarity of social workers with neuro-technologies and their ethical, legal, and social implications; b) What are the lifelong learning mechanisms put in place for social workers, and their utility and limitation as it pertains to learning about neuro-technologies, especially the ethical, legal, and social implications ;and c) What is the involvement of social workers as professionals and as citizens in the neuroethics and neurogovernance discourses? A qualitative research design is most appropriate for our project because we would like a more in-depth understanding of social workers' specific views and experiences (Braun & Clarke, 2013). We chose semi-structured interviews as our method of data collection because they are best suited for exploring understandings and perceptions participants have (Braun & Clarke, 2013), in this case on the impact of NA on social workers and their practice, and the utility of lifelong learning as a tool that can be used to empower social workers as professionals and citizens to influence neuroethics and neurogovernance discourses. Semi-structured interviews allowed us to guide the conversation towards our research questions and yet permit participants the opportunity to discuss issues that are important to them (Ball & Wolbring, 2014; Braun & Clarke, 2013; Creswell & Tashakkori, 2008), and this method allowed for impromptu clarification of questions.

Participants and Sampling

This study was approved by the Conjoint Health Research Ethics Board (CHREB) at the University of Calgary on February 23, 2018. Ten participants were recruited via purposive expert sampling. Interviews took place in the months of September 2018-January 2019. As to inclusion criteria, participants had to be social work practitioners, practicing for at least one year in Alberta. Participants were identified via the

Alberta College of Social Workers' (ACSW) website. Initial contact was made via email, and interviews were conducted face-to-face, over the phone, and through video conferencing platforms (Skype and Zoom).

Data Collection

This study was conducted using semi structured interviews developed by the researchers. A 25-question, 9 sub-question protocol was developed, keeping in mind the research questions, and prior knowledge of the literature by the researchers. Questions were a combination of yes and no and open-ended to encourage in-depth exploration of social workers' views related to the research questions. The protocol served as a template for the interview; additional, unscripted probing questions were asked as the interview progressed to clarify or further explore participants' responses. Data was collected using face-to-face and over the phone/video conferencing platforms for semi structured interviews lasting approximately 30 minutes to one hour.

Data Analysis

Raw data from interviews were analyzed using content analysis as described by Elo & Kyngäs (2008). Using Express Scribe® playback software, each interview recording was orthographically transcribed into Microsoft® Word, an audio style of transcription that focuses on what was said rather than how it was said (Braun & Clarke, 2013). We used ATLAS.ti-7©, a qualitative data analysis software, for analyzing the transcribed qualitative data. To protect the privacy and confidentiality of the participants, each of them was coded as "Participant 1," "Participant 2," etc., and all identifiable information was anonymized. The interview transcriptions were then uploaded in a PDF format into ATLAS.ti-7®. Interviews that were uploaded into ATLAS.ti-7© were read and content broken down into themes, organized into larger categories, and then the themes and patterns were interpreted as a whole (Elo & Kyngäs, 2008). Accordingly, we employed the systematic, six-phase thematic analysis process described by Braun and Clarke (Clarke & Braun, 2014). Both authors engaged in analysis, and codes were cross-checked between the two researchers. Our analysis was both deductive and inductive, as well as iterative. The investigators sought out the presence of certain themes based on the research

questions and the knowledge of the literature; however, themes were also generated as they were seen to emerge from the data. The interviews were reanalyzed twice after the initial coding to ensure that themes had not been overlooked. Once themes were gathered, they were organized by how they relate with one another and how the themes generalized into larger patterns. Finally, the overall interpretations of these themes and patterns were recorded in ATLAS.ti-7©. Throughout the analysis, the investigators engaged in peer debriefing and personal reflection to strengthen the validity of the findings.

Trustworthiness

Measures Credibility/dependability, transferability, and confirmability are four trustworthiness measures (Baxter & Jack, 2008; Lincoln & Guba, 1985; Shenton, 2004). To enhance credibility (Guba, 1981), both authors that coded the PDF containing the qualitative data engaged in peer debriefing. Differences in codes and theme suggestions were discussed between the two authors and revised as needed. Dependability is evident in the audit trail made possible by using Memo and coding functions within ATLAS.ti-7©. As to transferability, it is not the intent of our study to be generalizable; however, the data we provide allow for transferability whereby others can decide whether they might want to perform a similar study (Guba, 1981).

Limitations

Given the nature of this study there is the possibility of a selection bias, as only the ones that might have been interested in the topic might have agreed to be participants in the study. Interviews were conducted face-to-face and over the phone/video conferencing platforms, and although participants were guaranteed anonymity, they may not have been honest about some of their views. As such, social desirability bias is a possibility. Moreover, we only interviewed 10 social workers whose views may not be analogous across this field. However, despite its limitations, this study provided greater insight into the research questions the study covered.

Results

The findings in this study are presented in five sections: a) section one, demographics; b) section

two, familiarity of social workers with 37 neurotechnology's; c) section 3, identification of the ethical, legal, and social implications of neurotechnology in particular and technologies in general; d) section 4, involvement of participants in governance discussions as professionals and as active citizens and participants' perception of active citizenship as an identity for themselves and other professionals in their field; and e) section 5, participants' engagement with and views and use of lifelong learning and professional development mechanisms.

Demographics

We recruited 10 social workers. The age of participants ranged from 47 to 65 years of age, of which 8 practiced in clinical social work, 1 in resourcing, and 1 as a communications specialist. All 10 were female social workers practicing in Alberta; 2 of our participants are pursuing a master's degree in social work, while 3 are completing their PhD.

Familiarity with Neurotechnology's (NTs)

Participants displayed minimal knowledge of the term neurotechnology and pertinent products and processes; 3 were familiar with the term "neurotechnology," 4 were unfamiliar but could guess the meaning of the term, while 3 were not familiar with the term and could not give any meaning to it. In terms of specific products and processes that we offered as examples of neurotechnology, the results varied (Table 1).

Perceived Implication of NTs

When we inquired about participants' thoughts on the impact of NTs on social work, 6 stated that NTs will have a future impact on social work, 2 believed their field has already been impacted by NTs, while 4 stated that there is no current apparent impact. Some of the responses we received from participants who believed there is no current impact were that social work uses soft technologies, robots cannot replace counselling, and that the field is not capable of implementing NTs in practice. All participants stated that neurotechnology in particular and technologies in general will impact society. The following implications listed in Table 2 sum up their responses which were present more than once.

Table 1: Familiarity of Social Workers with Neurotechnology

Neurotechnology	Number of SWs who are familiar with it
1. Artificial Intelligence (AI)	10
2. Brain Imaging	10
3. Virtual Reality (VR)	9
4. EEG Biofeedback	9
5. Cochlear Implant	8
6. Bionic Eye	6
7. Brain Stimulation	6
8. Deep Brain Stimulation (DBS)	5
9. Biofeedback	5
10. Artificial Brain	4
11. Brain Computer Interface (BCI)	4
12. Cranial Electrotherapy Stimulation	4
13. Machine Intelligence	4
14. Neuro Stem Cells (NSC)	4
15. Auditory Brainstem Implant (ABI)	3
16. Brain to Speech Technology	3
17. Nootropics	3
18. Optogenetics	3
19. Speech Brain Computer Interface	3
20. Spinal Cord Stimulator	3
21. Muse Headband	2
22. Hemoencephalography (HEG)	2
23. Cognitive/Neuro Enhancement Beyond the Normal	1

Social Workers as Professionals and Citizens

24. Artificial Hippocampus	1
25. Brain to Text Technology	1
26. Electrocorticography (EcoG)	1
27. Facial Electromyography (fEMG)	1
28. Neurochip	1
29. subvocal speech device	1
30. transcranial direct current stimulation (tDCS)	1
31. transcranial magnetic stimulation (TMS)	1
32. sacral nerve stimulation	1
33. CoriQ electrocorticographic technologies	0
34. Cortical modem	0
35. Darpa Ram sensor	0
36. Emotiv	0
37. Whole Brain Emulation	0

Their knowledge of the neurotechnology listed in Table 1 was a result of the media (10), professional practice (6), research (3), usage (1), and conversation (1).

Following are some quotes addressing some of our participants' concerns involving emerging technologies. Very few concrete answers were obtained in relation to specific neurotechnology.

Participant 03: "we're balancing on the head of a pin with respect to how much technology has infiltrated you know it's I'm waiting for this some Orwellian kind of implosion of our culture can we have 18 month old's that know how to use an iPhone something is going to implode somewhere."

"we haven't stopped yet on balancing and juggling all of the other things we are also balancing and juggling and now we've just added that layer of technology which propels us through life so much faster."

Participant 6: "electronic medical records that nobody asked us if we wanted them. Yes there are committee members and they say they

represent everybody but I don't remember being asked."

Participant 9: "we tend to realize the implications after the fact when it's too late and the harm is done."

When asked about the importance of thinking in terms of and applying an ethical, legal, and social implication lens in everyday practice and life, all participants stated that they think in terms of ethical, legal, and social implications in everyday work and life. However, three qualified the answer by explicitly stating that they do not engage in thinking about implications when it comes to technologies, including neurotechnology. One participant further argued that neuroscientists would be more equipped to think and apply ethical, legal, and social implication lenses in their work and life. Six participants stated it was beneficial for clients as it aids in restoring normality; five believed it is im-

Table 2: Ethical, Legal, and Social Implications of NTs

Ethical Implications		Legal Implications		Social Implications	
Safe Space	4	Privacy	7	Restoring normality	6
Risks and Benefits	4	Liability	5	Social emotional Functioning	5
Low Standard	3	Cyber Security	3	Addiction	4
Confidentiality	3	Not considered	3	Access	3
Access	3	Human Rights	2	Security	3
Mindsets	2			Information	3
Informed Consent	2			Control and Power	3

Three social workers acknowledge that current standards for ethics lag behind technological advancements, meaning new ethical issues are emerging faster than the concerned bodies' solutions and guidelines.

portant to be aware of implications, especially as they become more prominent; and two brought up the need to address society's lack of long-term planning. None of our participants received training on how to deal with ethical, legal, and social implications of neurotechnology or technologies in general. Five received no ethical, legal, and social implication training at all, even as it relates to their everyday work engagement, while n=5 were trained on basic ethics of confidentiality and safe space.

Participation in Governance

The Case of Active Citizenship.

Social workers are not only professionals but also citizens. One of the roles of citizens is to engage in discussions that shape society. Social action and active citizenship are themes present in the social work literature. However, only one participant was familiar with the concept of active citizenship. Once we provided the definition, only two participants identified themselves as being active citizens who are involved in advocacy, though not in terms of technology, while eight did not contribute to public discussions. Although the

majority of our participants were not acting as active citizens, seven participants believed that social workers in general are indeed active citizens, as they are grassroots activists and experts in advocacy through vocalizing concerns on issues of homelessness, sexual abuse, domestic violence, bullying, and harassment. Participants further indicated that social workers are trained to think with a social justice lens. Participant 2, for example, stated, "[Social workers] do a lot of advocacy and empowerment work and they feel like they are bettering society." At the same time, participants thought that only those who are interested in social change actively engage in societal discussions. Of the participants, six felt that social workers should be involved in sociopolitical discussions around technologies, but only two stated social workers are, and five stated that social workers aren't. Furthermore, six stated that social workers have expertise to contribute to the discussions around the impact of technologies, and one stated social work does not have much to contribute.

When we inquired about why our participants did not engage in active citizenship in terms of technology and why they believed other social

workers do not as well, we received the following responses:

- Eight participants indicated it was an issue with society and the prejudices it holds when it comes to social work as a field. The field of social work is undervalued and often misunderstood to be about child protection. Similarly, social workers are not respected nor recognized as experts. Participant 5 stated, “I would say society doesn’t see social workers as being essential to for example government policy or populations umm I just think we’re not seen as essential.”
- Participant 2 stated, “I think with any new emerging technology they are very careful about how they present it, and they want people that are enthusiastic about it. I think that, you know, it’s amazing and wonderful and stuff and talk about benefits I think a lot of times they don’t wanna* talk about social workers’ position so they don’t want to talk to people like social workers who might have questions or you know might want to have a different perspective on it so I think it’s a very carefully crafted exposure to the world. I think if anything people are very smart about how they want to present it so when you control the information going out, and social workers aren’t really good at that part,” suggesting that the techno-optimistic premise of technology discourses hinders the involvements of social workers.
- Five participants associated their lack of engagement with technology developers. These participants claim that developers purposefully leave social workers out of the discussion because they do not want their products to be questioned as they are careful about how they present them. Additionally, they stated that developers fail to look at practice fields in general, and they fail to look at the bigger picture in terms of the effects their products will have.
- Two participants took responsibility and attributed their lack of engagement with their profession. They argued that social workers lacked imagination and have a narrow vision. Participant 2 argued, “SWs like to think they’re bettering society, but they have very narrow opinions and they fail to look at the broader context.”

Contribution Potential of Social Work

Although our participants are not engaged in governance discussions on the implications of neurotechnology in particular, and emerging technologies in general, four indicated that they do have a lot to contribute as a field and as individuals. They made the case that social workers have a unique take on real world experiences, are experts in advocacy, and have an understanding of the mechanisms of oppression. Participant 8 stated that social workers are trained in “how to dismantle power, how to understand the mechanisms of oppression and advocate for people, becoming an ally.

However, two believed that having such perspective does not give social workers exclusivity in terms of contribution to the governance of science and technology. Finally, four stated that there isn’t much to be done as a social worker, as they lack the knowledge and expertise on all matters technology related. Participant 4 stated, “Haha, it’s like you’re opening a can of worms. I think that social workers are extremely frustrated that our professional association isn’t correcting that image of social workers and showing exactly what social workers do and their capabilities and abilities and making us a much more recognized profession.”

Lifelong Learning and Professional Development: Social Workers’ Engagement

All participants engaged in lifelong learning and professional development as part of their professional requirement. Additionally, three participants reported that they are active lifelong learners.

When asked about the reasons why they engaged in lifelong learning and professional development activities, six participants stated it was a requirement, five stated it was an essential aspect of their work, while two indicated it was out of interest or done to enhance their CV. Table 3 outlines some of the factors our participants believed to contribute to and detract from seeking lifelong learning opportunities.

When asked about the importance of lifelong learning, seven participants stated it was needed to provide best practice, four believed it was necessary to remain up to date with new advancements, three indicated it was important to

Table 3: Factors that contribute to or detract from lifelong learning

Positive		Negative	
Curiosity	7	Access	9
Avoid stagnation	4	Money	9
Best Practice	3	Time	7
Professional Requirement	2	Confidence	2
Personal development	2	Attitudes	4

avoid stagnation, and two believed it was a necessity for professional development. In terms of using lifelong learning to learn about advancements in neurotechnology, four participants stated that they used informal learning (media and entertainment) or learned about technological advancements through practice, one indicated that they learned about NTs unintentionally, while three did not use lifelong learning to learn about NTs. None used lifelong learning to learn about ethical, legal, and social implications of NT or science and technology in general.

Discussion

Our findings suggest that the state of knowledge on NA was limited, and participants were not involved in discussions surrounding the social, legal, or ethical implications of NA. Participants saw social workers as active citizens and as individuals that could contribute to ethics and governance of science and technology, including NA; however, they did not see themselves and social workers in general to be active citizens in relation to the ethical, legal, and social implications of science and technology, including NA. Participants demonstrated a great emphasis on lifelong learning, yet lifelong learning was not a learning mechanism used to remain informed about the potential and emerging ethical, legal, and social consequences of NA in particular and emerging technologies in general.

Given the impact of NA on social work, the potential utility of lifelong learning, and the role

expectation of social workers as professionals and citizens, our findings indicate opportunities for lifelong learning and the involvement of social work and social workers as professionals and active citizens in the discussions around the governance of NA. In the remainder of this section, we discuss our findings through social work's self understanding as a field, literature around active citizenship, and literature around lifelong learning/professional development and the goals of neuroethics and neurogovernance.

Social Work's Self Understanding as a Field

Social work states that they aim to recognize the various factors that may result in opportunities or barriers for the wellbeing of people and may perpetuate inequalities, discrimination, exploitation, and oppression (IFSW, 2016). The profession's goal is to empower and support the liberation of all people (IFSW, 2016); to contribute to advocacy from local, national, regional, and/or international affairs (IFSW, 2012c); and participate in "social and political action to impact social policy and economic development" International Federation of Social Workers (IFSW) (2012c, p. 5). The social work profession declares the human rights of life, freedom and liberty, equality and non-discrimination, justice, solidarity, peace and non-violence, social responsibility, and the environment of utmost importance and works to eliminate all violations of these rights (IFSW, 2012f). Areas of social work engagement are guided by many social-oriented and ground level, before the direction is set in stone as it relates to

NA to influence neurogovernance discourses for the benefit of its clients, which includes marginalized and oppressed groups of people, including disabled people.

The Preamble of the Canadian Association of Social Work's Code of Ethics states, "The social work profession is dedicated to the development and disciplined use of scientific and professional knowledge" (Canadian Association of Social Workers, 2005, p. 3). We contend that the goal of "development and disciplined use of scientific and professional knowledge" (Canadian Association of Social Workers, 2005, p. 3) entails that one is engaged in the governance of scientific and technological developments.

For social work faculty, students, and practitioners to be involved in an anticipatory way in the governance of NA processes and products is essential, given that "the profession has a particular interest in the needs and empowerment of people who are vulnerable, oppressed, and/or living in poverty" (Canadian Association of Social Workers, 2005, p. 3), groups that are normally not part of neurogovernance discourses and for that matter in the governance of many scientific and technological advancements such as artificial intelligence (Deloria et al., 2019; Lillywhite & Wolbring, 2019) and gene editing (Wolbring & Diep, 2016), but who are at the same time severely impacted by such developments. Social work students, faculty, and practitioners would benefit from being part of neurogovernance discourses. Social work students would be enabled to learn about emerging NA and what others think might be potential social, ethical, legal, and economic issues and to influence the discourse by giving the views of social work when the trajectory of development can still be influenced. The neurogovernance discourse might benefit from how social work approaches social justice, oppression, and social change and its focus on marginalized populations.

Active Citizenship

As much as social workers could and should be knowledgeable of especially the social and ethical issues raised by NA and other scientific and technological advancements given the role expectation and identity of social workers as professionals, social workers are also citizens and as such have a role to play in the governance discussions under the identity of being an active

citizen. Early involvement of actors such as public citizens, developers, engineers, policy-makers, and other actors to construct conversations around awareness, reaction, and knowledge development and sharing (Cheung & Wolbring, 2017; Flipse et al., 2016; Gregory et al., 2016; Guston, 2014) is seen as important, as is that the societal discussions of science and technology advancement should be a constant endeavor (Einsiedel, 2004). Social workers under the role and identity of being a professional and being a citizen fits with these demands.

Various studies link social workers to the concept of being active citizens. It is argued that it is the role of social workers to uphold active citizenship (Dominelli, 2013; Raitakari et al., 2019, p. 276). As such it is noteworthy that most participants in our study were not familiar with the concept of active citizens, although once they were told what it means, most participants indicated that social workers act as active citizens, but not in relation to the governance of NA or scientific and technological governance in general.

A recent survey found that over 75% of participants agreed or strongly agreed that "actions for improving social conditions should be a primary responsibility for all social workers" (Dickinson, 2004, pp. 15, Table 16). And the same survey revealed many reasons for non-involvement in social action, many of them personal ones such as lack of time and energy (Dickinson, 2004). Interestingly, our participants saw their lack of engagement less in their personal situation but in systemic issues; eight indicated it was an issue with society and the prejudices it holds when it comes to social work as a field. Five associated their lack of engagement with technology developers. Two participants took responsibility and attributed their lack of engagement to their profession. They argued that social workers lacked imagination and have a narrow vision. As to tactics for social actions, many are available, such as sharing one's knowledge with the public, lay groups and policy makers, writing pieces for media, and empowering clients to get involved (Dickinson, 2004). However, all these actions require knowledge which our participants did not have in relation to NA. Indeed, four of our participants stated that there isn't much to be done as a social worker, as they lack the knowledge and expertise

on all matters technology related.

Lifelong Learning

The state of knowledge of the public on a given scientific or technological advancement like NA is a recurring theme in science and technology discussions (Funk et al., 2016; Toumey, 2011; Wolbring, 2012b). Our findings suggest that social workers do not have enough knowledge to partake in the discussions around social implications of scientific and technological advancements, including NA. Our findings fit with the conclusion of Bell, Leger, Sankar and Racine (2016), who make the case that “trainees from diverse healthcare professions (e.g., nursing, social work, physiotherapy) are not well prepared to handle many of the ethical issues associated with psychiatric DBS because, among other reasons, they may be unprepared to engage in ethical reflection, they have a limited understanding of issues associated with scientific uncertainty, and they may lack an interdisciplinary understanding about ethical issues” (Bell et al., 2016, p. 6). They conclude that there is a “need for tailored ethics training for staff members and an increased awareness of how the healthcare professionals’ previous training shapes their process of ethical reflection” (Bell et al., 2016, p. 6). Life-long learning/professional development, a cornerstone of social work (Canadian Association for Social Work Education, 2015; Canadian Association of Social Workers, 2005, 2017a), could be but was not used, according to our participants, to a) learn about NA and the ethical, legal’ and social issues in a continuous and anticipatory level; b) to empower practitioners to not only be passive recipients of knowledge but to actively contribute to the neurogovernance discussions; and c) to be moral actors as argued for by Bell et al. (2016) and as discussed extensively in the social work literature (Chu et al., 2009; Stanford, 2011).

If a participant learned about a NA it was due to personal interest outside of work and in a sporadic fashion and not on the level needed to contribute in a meaningful way to the discussions around the potential impact of NA on social issues that fit within the scope of social work.

Our participants highlighted various barriers to their professional development/lifelong learning, many of which were in sync with the barriers identified by social workers in other studies

(Dudziak & Profitt, 2012; Gray, 2011; Petruik et al., 2017). Some of our participants felt that they should have learned during their degree that they have to look out through lifelong learning for governance knowledge which we posit includes not only to learn about how to use technology as social workers in an ethical way but also to be able to evaluate societal impacts of emerging technologies.. All participants felt that they were not sensitized during their degree on the importance of staying afloat of the science and technology governance discussions and due to the lack of sensitization that they don’t even realize what they do not know. Indeed, others wrote about this gap in the teaching (Dudziak & Profitt, 2012; Gray, 2011).

Goals of Neuroethics and Neurogovernance

As much as our findings are deeply troubling for the social work field, our findings are just as deeply troubling for the various discourses that focus on the governance of NA and scientific and technological advancements in general.

Sherwin (2011), a leading ethicist, concluded that “we [ethicists] lack the appropriate intellectual tools for promoting deep moral change in our society” (p. 80). Our findings suggest that the knowledge is not present with our participants to even be aware of what moral change is needed. Many of the social and ethical issues discussed in the neuroethics and neurogovernance discussions were not identified by our participants. According to Morein-Zamir and Sahakian (2010), public engagement consists of societal members’ opportunity to inform researchers and scientists on the development of practices and policies. Social workers fit this mandate perfectly, but our findings suggest they simply do not have enough knowledge to influence the public engagements. Stahl, Flick and Timmermans (2016) argue that debates have moved beyond the academic community to include multiple societal stakeholders including the mass media, policy makers, and citizens. Social workers are stakeholders in their role and identity as professionals and as active citizens. But their knowledge is not enough. Our findings raise the question of why social workers do not have the knowledge. Part of the problem as identified by the participants is their field and the employment environment. But our participants were also clear that another main problem is how

they are viewed and engaged with by others; for example, Participant 5 stated, “I would say society doesn’t see you know social workers as um as being essential to for example government policy or umm you know populations umm I just think we’re not seen as essential.”

Within the discussions of science and technology governance, science education and knowledge creation play a central role (Bauer et al., 2016; de Saille, 2015; Diep et al., 2015; European Commission, 2012; Expert Group on Policy Indicators for Responsible Research and Innovation of the European Commission, 2015; Guston, 2010; Owen et al., 2012; Wolbring & Diep, 2014, 2016). However, lifelong learning and professional development of social workers are not thematized within the management of the societal aspects of advancements in science and technology and NA, which we posit to be problematic. Indeed, as much as science and technology governance terms do not show up in social work academic literature (Wolbring & Diep, 2014), a quick search (February 1st, 2020) in the database Scopus for the presence of “social work*” in the abstracts of journals covering ethics issues such as “neuroethics” revealed 0 hits for the 699 articles with neuroethics in the journal title, the 385 articles with “responsible innovation” in the journal title, the 318 articles with nanoethics in the title, and the 1761 articles with science and engineering ethics in the title, suggesting that the problem is as much on the side of the governance academic discourse as on the social work side.

Conclusion

Our findings suggest that the state of knowledge on NA was limited, and participants were not involved in discussions surrounding the social, legal, or ethical implications of NA. Participants saw social workers as active citizens and as individuals that could contribute to ethics and governance of science and technology, including NA; however, they did not see themselves and social workers in general to be active citizens in relation to the ethical, legal, and social implications of science and technology, including NA. Participants demonstrated a great emphasis on lifelong learning, yet lifelong learning was not a learning mechanism to remain informed about the potential and emerging

ethical, legal, and social consequences of NA in particular and emerging technologies in general. Our findings are problematic given the self understanding of the social work field and the goals of the science and technology governance discourses, including the neurogovernance discourses, given the many intersections between NA and social work (Ashworth, 2018; Bellet al., 2016; Bell et al., 2009; Black & Conway, 2018; Eack, 2012; Eack et al., 2018; Farmer, 2008; Garland & Howard, 2018; Gerdes, Lietz, et al., 2011; Gerdes, Segal, et al., 2011; Gerdes et al., 2010; Hack et al., 2015; Hunter et al., 2018; Huttar & BrintzenhofeSzoc, 2019; Johnson, 2001; Li et al., 2019; Matto & Strolin-Goltzman, 2010; McMahan, 2015; McMillan & Wood, 2017; Page et al., 2012; Pray & Jordan, 2010; Shapiro & Applegate, 2000; Stankus, 2008; Trahan et al., 2019; Various, 2016; Wojtalik et al., 2018; Yates et al., 2017) and the diverse ways social workers as professionals and citizens, social work clients as clients and as citizens, and social work practice can be impacted by NA:

- a) as potential non-therapeutic users (consumer)
- b) as potential non-therapeutic users (client educator and educator of public)
- c) as potential therapeutic users (professional practice, client use)
- d) as potential therapeutic users (professional practice, client educator and educator of public)
- e) by changing societal parameters caused by humans using NA, impacting the social worker as citizen (military, changes in how humans interact, employer using it in the workplace...)
- f) by changing societal parameters caused by humans using NA, impacting the client of social worker (military, changes in how humans interact, employer using it in the workplace...)
- g) by changing societal parameters caused by humans using NA, impacting social work practice (military, changes in how humans interact, employer using it in the workplace...)

For social work faculty, students, and practitioners to be involved in an anticipatory way in the governance of NA and other emerging technologies seems to be particularly essential given that “the profession has a particular interest in the needs and empowerment of people who are

vulnerable, oppressed, and/or living in poverty” (Canadian Association of Social Workers, 2005, p. 3), groups that are normally not part of the governance of science and technology discourses but who are at the same time severely impacted by such developments (Diep, 2017).

Our results fit with a 2014 study that found a lack of engagement of academic social work with robots, brain machine interfaces, human enhancement (including neuro-enhancement), and science and technology governance discourses (Wolbring & Diep, 2014). It also fits with the lack of engagement with social work in academic journals focusing on neuroethics and neurogovernance issues (based on a short Scopus review we performed for this article). Furthermore, it reflects a study stating “trainees from diverse healthcare professions (e.g., nursing, social work, physiotherapy) are not well prepared to handle many of the ethical issues associated with psychiatric DBS because, among other reasons, they may be unprepared to engage in ethical reflection, they have a limited understanding of issues associated with scientific uncertainty, and they may lack an interdisciplinary understanding about ethical issues” (Bell et al., 2016, p. 6). Finally, it fits with the limited role narrative of social workers within the artificial intelligence and machine learning discourses (Villamil et al., 2019). Many of the answers of our participants are similar to some found with occupational therapy students (Djebrouni et al., 2019) indicating that the problem is broader than social work, which fits also with (Bell et al., 2016), who questioned the knowledge of various health professions.

Our findings outline a major gap in how social work and the neuroethics and neurogovernance discourses interact. To rectify the problematic findings of our study, various future studies could be undertaken.

We must better understand why there is the disconnect between social work and science and technology governance scholars, including neuroethics and neurogovernance scholars. Another angle of investigation should be to investigate the social work and the governance curricula to see whether they still do not intersect, and if that is the case, to interview educators from both areas to explore why that is. Indeed, some of our participants stated that they do not even know what they do not know and that they simply never

learned as students about the importance of being part of science and technology governance discussions, including the neuroethics and neurogovernance discourses.

Given the extensive literature on students such as undergraduate students as knowledge producers, it could also be useful to investigate why social work students are not acting as knowledge producers on the topics we found lacking.

Finally, future research using role, stakeholder, and identity theories as lenses to investigate in more details what identities, roles, and stakes social workers associate for themselves in relation to advancements in science and technology could also be conducted. Our study was only a first step, and more could be done using focus groups, online surveys, and more interviews to see if they replicate the same findings we have obtained in relation to NA but also in relation to other emerging technologies such as artificial intelligence and machine learning.

Funding: Government of Canada, Canadian Institutes of Health Research, Institute of Neurosciences, Mental Health and Addiction ERN 155204 in cooperation with ERA-NET NEURON JTC 2017

References

- Ashworth, D. (2018). Bionic Vision, Social Work, and Community Development: A Research Participant's Reflections *Health and Social Work*, 43(1), 51-58. <https://doi.org/10.1093/hsw/hlx043>
- Ball, N., & Wolbring, G. (2014). Cognitive Enhancement: Perceptions Among Parents of Children with Disabilities. *Neuroethics*, 7(3), 345-364. <http://link.springer.com/article/10.1007/s12152-014-9201-8>
- Barton, A. C. (1997). Liberatory science education: Weaving connections between feminist theory and science education. *Curriculum Inquiry*, 27(2), 141-163.
- Bauer, A., Bogner, A., & Fuchs, D. (2016). Report on the expert workshop "Contemporary experiences with societal engagement under the terms of RRI". Austrian Academy of Sciences, Institute of Technology Assessment. Retrieved August 11, 2020 from http://www.proso-project.eu/wp-content/uploads/proso_d2.1_rri_expert_workshop.pdf
- Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, 13(4), 544-559.
- Belchior Rocha, H. (2018). Social work practices and the ecological sustainability of socially vulnerable communities. *Sustainability*, 10(5), article 1312.
- Bell, E., Leger, P., Sankar, T., & Racine, E. (2016). Deep brain stimulation as clinical innovation: an ethical and organizational framework to sustain deliberations about psychiatric deep brain stimulation. *Neurosurgery*, 79(1), 3-10.
- Bell, E., Mathieu, G., & Racine, E. (2009). Preparing the ethical future of deep brain stimulation [Article]. *Surgical Neurology*, 72(6), 577-586. <https://doi.org/10.1016/j.surneu.2009.03.029>
- Bell, E., & Racine, E. (2013). Clinical and ethical dimensions of an innovative approach for treating mental illness: a qualitative study of health care trainee perspectives on deep brain stimulation. *Canadian Journal of Neuroscience Nurses*, 35(3), 23-32.
- Black, J. M., & Conway, A. (2018, 2018/06/01). The Utility of Neuroscience for Social Work Research and Practice With Children and Adolescents. *Journal of the Society for Social Work and Research*, 9(2), 261-284. <https://doi.org/10.1086/698166>
- Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. Sage.
- Buell, B. (1926). Some Responsibilities of the Professional Social Worker. *Social Forces*, 4(4), 741-745.
- Burns, E. M. (1947). Social action and the professional social worker. *The Compass*, 28(4), 37-40.
- Canadian Association for Social Work Education. (2015). *Standard For Accreditation* Canadian Association for Social Work Education. Retrieved August 11, 2020 from <http://caswe-acfts.ca/wp-content/uploads/2013/03/CASWE-ACFTS-Standards-11-2014.pdf>
- Canadian Association of Social Workers (2005). *The Canadian Association of Social Work's Code of Ethics* Canadian Association of Social Workers. Retrieved August 11, 2020 from https://www.casw-acts.ca/sites/default/files/attachements/casw_code_of_ethics_0.pdf
- Canadian Association of Social Workers. (2017a). *Professional Development*. Canadian Association of Social Workers. Retrieved August 11, 2020 from <http://www.casw-acts.ca/en/javascript%3A%20void%280%29%3B/professional-development>
- Canadian Association of Social Workers. (2017b). *Scope of practice*. Canadian Association of Social Work. Retrieved August 11, 2020 from https://www.casw-acts.ca/sites/default/files/attachements/scope_of_practice_august_08_e_final_17.pdf
- Canadian Association of Social Workers (CASW). (2009). *Guidelines for the development of professional practice legislation*. Canadian Association of Social Workers. Retrieved August 11, 2020 from https://www.casw-acts.ca/sites/default/files/attachements/guidelines_for_development_of_professional_practice_final_may09.pdf
- Carraz, R. (2012). Improving science, technology and innovation governance to meet global challenges. In *Meeting Global Challenges through Better Governance International Co-operation in Science, Technology and Innovation: International Co-operation in Science, Technology and Innovation* (pp. 173-207). OECD Publishing.

- Carter, L. (2004). Thinking differently about cultural diversity: Using postcolonial theory to (re) read science education. *Science Education*, 88(6), 819-836.
- Cheung, J., & Wolbring, G. (2017). Staff's Views From One Canadian Organ Procurement Organization on Organ Donation and Organ Transplant Technologies: A Content Analysis. *NanoEthics*, 11(2), 187-202. <https://doi.org/https://doi.org/10.1007/s11569-017-0292-7>
- Chu, W. C., Tsui, M.-s., & Yan, M.-c. (2009). Social work as a moral and political practice. *International Social Work*, 52(3), 287-298.
- Clarke, V., & Braun, V. (2014). Thematic analysis. In T. Teo (Ed.), *Encyclopedia of critical psychology* (pp. 1947-1952). Springer.
- Clausen, J. (2011). Conceptual and ethical issues with brain–hardware interfaces. *Current Opinion in Psychiatry*, 24(6), 495-501.
- Creswell, J., & Tashakkori, A. (2008). Editorial. Mixed Methodology Across Disciplines. *Journal of Mixed Methods Research*, 2(1), 3-6.
- Csiernik, R., Furze, P., Dromgole, L., & Rishchynski, G. M. (2006). Information Technology and Social Work—The Dark Side or Light Side? *Journal of Evidence-Based Social Work*, 3(3-4), 9-25.
- Dalhousie University School of Social Work. (2015). *Vision, Mission & Guiding Principles*. Dalhousie University School of Social Work. Retrieved August 11, 2020 from <http://www.dal.ca/faculty/healthprofessions/socialwork/about/vision-mission-guiding-principles.html>
- de Saille, S. (2015). Dis-inviting the Unruly Public. *Science as Culture*, 24(1), 99-107. <https://doi.org/10.1080/09505431.2014.986323>
- Deloria, R., Lillywhite, A., Villamil, V., & Wolbring, G. (2019). How research literature and media cover the role and image of disabled people in relation to artificial intelligence and neuro-research. *Eubios Journal of Asian and International Bioethics (EJAIB)*, 29(5), 169-182.
- Dickinson, J. C. (2004). The views of NASW members in one state toward social action. *Professional Development: The International Journal of Continuing Social Work Education*, 7(2).
- Diep, L. (2017). Anticipatory Governance, Anticipatory Advocacy, Knowledge Brokering, and the State of Disabled People's Rights Advocacy in Canada: Perspectives of Two Canadian Cross-Disability Rights Organizations University of Calgary]. University repository. https://prism.ucalgary.ca/bitstream/handle/11023/4051/ucalgary_2017_diep_lucy.pdf?sequence=3&isAllowed=y
- Diep, L., Cabibihan, J. J., & Wolbring, G. (2015). *Social Robots: Views of special education teachers*. Paper presented at the 3rd Workshop on ICTs for improving Patients Rehabilitation on Research Techniques 01st-02nd of October 2015 University Lusófona de Humanidades e Tecnologías Lisbon, Portugal <https://doi.org/10.1145/2838944.2838983>.
- Djebrouni, M., Phelan, S., Aldersey, H., & Wolbring, G. (2019). Utility of science, technology and innovation governance for occupational discourses from the perspective of occupational therapy students. *Work*, 64(2), 249-270. <https://doi.org/10.3233/WOR-192990>
- Dominelli, L. (2013). Environmental justice at the heart of social work practice: Greening the profession [Article]. *International Journal of Social Welfare*, 22(4), 431-439. <https://doi.org/10.1111/ijsw.12024>
- Dos Santos, W. L. (2009). Scientific literacy: A Freirean perspective as a radical view of humanistic science education. *Science Education*, 93(2), 361-382.
- Dudziak, S., & Profitt, N. J. (2012). Group work and social justice: Designing pedagogy for social change. *Social Work with Groups*, 35(3), 235-252.
- Eack, S. M. (2012). Cognitive remediation: A new generation of psychosocial interventions for people with schizophrenia. *Social Work (United States)*, 57(3), 235-246. <https://doi.org/10.1093/sw/sws008>
- Eack, S. M., Black, J. M., & Hunter, R. G. (2018). Introduction to the Special Section on Social Work and Neuroscience. *Journal of the Society for Social Work and Research*, 9(2), 217-221.
- Egan, M., Neely-Barnes, S. L., & Combs-Orme, T. (2011). Integrating neuroscience knowledge into social work education: A case-based approach. *Journal of Social Work Education*, 47(2), 269-282.
- Einsiedel, E. F. (2004). Commentary: On the

- position paper of the Ethics Committee of the International Xenotransplantation Association. *Transplantation*, 78(8), 1110-1111.
- Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), 107-115.
- European Commission. (2012). *Responsible Research and Innovation: Europe's ability to respond to societal challenges*. European Commission Retrieved August 11, 2020 from http://ec.europa.eu/research/swafs/pdf/pub_rri/KI0214595ENC.pdf
- Expert Group on Policy Indicators for Responsible Research and Innovation of the European Commission. (2015). *Indicators for promoting and monitoring Responsible Research and Innovation*. European Commission. Retrieved August 11, 2020 from http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf
- Farah, M. J. (2005). Neuroethics: the practical and the philosophical. *Trends in cognitive sciences*, 9(1), 34-40.
- Farmer, R. L. (2008). *Neuroscience and social work practice: The missing link*. Sage Publications.
- Field, J., & Schemmann, M. (2017). International organisations and the construction of the learning active citizen: An analysis of adult learning policy documents from a Durkheimian perspective. *International Journal of Lifelong Education*, 36(1-2), 164-179.
- Flipse, S., Vrieling, J. O., & van der Sanden, M. (2016). Building Interactive Communication Tools to Support Interdisciplinary Responsible Innovation. *Journal of Innovation Management*, 3(4), 119-133.
- Funk, C., Kennedy, B., & Podrebarac Scrupac, E. (2016). *Public opinion on the future use of brain implants*. Pew Research Center. Retrieved August 11, 2020 from <http://www.pewinternet.org/2016/07/26/public-opinion-on-the-future-use-of-brain-implants/>
- Garden, H., & Winickoff, D. (2018). *Issues in neurotechnology governance*. ECD Science, Technology and Industry Working Papers, No. 2018/11. Retrieved August 11, 2020 from <https://www.oecd-ilibrary.org/content/paper/c3256cc6-en>
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, 38(4), 915-945.
- Garland, E. L., & Howard, M. O. (2018, 2018/06/01). Enhancing Natural Reward Responsiveness Among Opioid Users Predicts Chronic Pain Relief: EEG Analyses From a Trial of Mindfulness-Oriented Recovery Enhancement. *Journal of the Society for Social Work and Research*, 9(2), 285-303. <https://doi.org/10.1086/697685>
- Gerdes, K. E., Lietz, C. A., & Segal, E. A. (2011). Measuring empathy in the 21st century: Development of an empathy index rooted in social cognitive neuroscience and social justice. *Social Work Research*, 35(2), 83-93.
- Gerdes, K. E., Segal, E. A., Jackson, K. F., & Mullins, J. L. (2011). Teaching empathy: A framework rooted in social cognitive neuroscience and social justice. *Journal of Social Work Education*, 47(1), 109-131.
- Gerdes, K. E., Segal, E. A., & Lietz, C. A. (2010). Conceptualizing and measuring empathy [Article]. *British Journal of Social Work*, 40(7), 2326-2343. <https://doi.org/10.1093/bjsw/bcq048>
- Gray, M. (2011). Back to basics: A critique of the strengths perspective in social work. *Families in Society*, 92(1), 5-11.
- Gregory, R., Satterfield, T., & Hasell, A. (2016). Using decision pathway surveys to inform climate engineering policy choices. *Proceedings of the National Academy of Sciences*, 113(3), 560-565.
- Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Technology Research and Development*, 29(2), 75-91.
- Guston, D. (2010, November). The Anticipatory Governance of Emerging Technologies. *Journal of Korean Vacuum Society*, 19(6), 432-441.
- Guston, D. (2014, April 1, 2014). Understanding 'anticipatory governance'. *Social Studies of Science*, 44(2), 218-242.
- Hack, N., Akbar, U., Monari, E. H., Eilers, A., Thompson-Avila, A., Hwynn, N. H., Sriram, A., Haq, I., Hardwick, A., Malaty, I. A., & Okun, M. S. (2015). Person-centered care in the home setting for parkinson's disease: Operation house call quality of care pilot study. *Parkinson's Disease*, Article 639494.

- <https://doi.org/10.1155/2015/639494>
- Hardina, D. (1994). Social action and the Canadian social worker: A study in the political economy of the profession. *Journal of Community Practice*, 1(2), 113-130.
- Harris, A., & Roose, J. (2014). DIY citizenship amongst young Muslims: Experiences of the 'ordinary'. *Journal of Youth Studies*, 17(6), 794-813.
- Hodson, D. (1999). Going beyond cultural pluralism: Science education for sociopolitical action. *Science Education*, 83(6), 775-796.
- Houston, S. (2001). *Social Work and Innovation: An Anthology of Advanced level Practice*. Central Council for Education and Training in Social Work (CCETSW).
- Hunter, R. G., Gray, J. D., & McEwen, B. S. (2018, 2018/06/01). The Neuroscience of Resilience. *Journal of the Society for Social Work and Research*, 9(2), 305-339. <https://doi.org/10.1086/697956>
- Huttar, C. M., & BrintzenhofeSzoc, K. (2019). Virtual Reality and Computer Simulation in Social Work Education: A Systematic Review. *Journal of Social Work Education*. <https://doi.org/10.1080/10437797.2019.1648221>
- International Federation of Social Workers (IFSW). (2012a). *Ageing and older adults*. IFSW. Retrieved August 11, 2020 from <http://ifsw.org/policies/ageing-and-older-adults/>
- International Federation of Social Workers (IFSW). (2012b). *Displaced Persons*. Retrieved August 11, 2020 from <http://ifsw.org/policies/displaced-persons/>
- International Federation of Social Workers (IFSW). (2012c). *Global standards*. IFSW. Retrieved August 11, 2020 from <http://ifsw.org/policies/global-standards/>
- International Federation of Social Workers (IFSW). (2012d). *Globalisation and the environment*. IFSW. Retrieved August 11, 2020 from <http://ifsw.org/policies/globalisation-and-the-environment/>
- International Federation of Social Workers (IFSW). (2012e). *Health*. Retrieved August 11, 2020 from <http://ifsw.org/policies/health/>
- International Federation of Social Workers (IFSW). (2012f). *Human rights*. IFSW. Retrieved August 11, 2020 from <http://ifsw.org/policies/human-rights-policy/>
- International Federation of Social Workers (IFSW). (2012g). *Women*. Retrieved August 11, 2020 from <http://ifsw.org/policies/women/>
- International Federation of Social Workers (IFSW). (2016). *Global Definition of Social Work*. Retrieved August 11, 2020 from <http://ifsw.org/get-involved/global-definition-of-social-work/>
- International Federation of Social Workers IFSW. (2012). *People with disabilities*. Retrieved August 11, 2020 from <http://ifsw.org/policies/people-with-disabilities/>
- Irwin, A. (2008). STS Perspectives on Scientific Governance. In E. J. Hackett, O. Amsterdamska, M. Lynch, & J. Wajcman (Eds.), *The handbook of science and technology studies* (pp. 583-609). The MIT Press.
- Johnson, H. C. (2001, 2001/08/01). Neuroscience in Social Work Practice and Education. *Journal of Social Work Practice in the Addictions*, 1(3), 81-102. https://doi.org/10.1300/J160v01n03_06
- Knapper, C., & Cropley, A. J. (2000). *Lifelong learning in higher education*. Psychology Press.
- Lee, P. R. (2009, 2009/08/31). The Social Worker and Social Action: Address Delivered Before the New York State Conference on Social Work, 1935. *Journal of Community Practice*, 17(3), 327-333. <https://doi.org/10.1080/10705420903118450>
- Levy, N. (2008). Introducing neuroethics. *Neuroethics*, 1(1), 1-8.
- Li, J. C. M., Tang, J. K. T., & Jia, C. X. S. (2019). Virtual offender: a pilot project on nurturing social work students' capacity to work with offenders. *China Journal of Social Work*, 12(1), 56-69. <https://doi.org/10.1080/17525098.2019.1622206>
- Li, Z. (2017). Citizenship education 'goes global': extra-curricular learning in an overseas campus of a British civic university. *International Journal of Lifelong Education*, 36(6), 662-678.
- Lillywhite, A., & Wolbring, G. (2019). Coverage of ethics within the artificial intelligence and machine learning academic literature: The case of disabled people. *Assistive technology, Latest Articles*, 1-7. <https://doi.org/10.1080/10400435.2019.1593259>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.
- Lister, R. (1998). *Citizenship on the margins*.

- Citizenship, social work and social action. *European Journal of Social Work*, 1(1), 5-18.
- Lucio-Villegas, E. (2014). Basic Skills for becoming a Citizen. In *Challenging the European Area of Lifelong Learning* (pp. 41-50). Springer.
- Macnaghten, P., Kearnes, M. B., & Wynne, B. (2005). Nanotechnology, governance, and public deliberation: what role for the social sciences? *Science communication*, 27(2), 268-291.
- Manning, S. S. (1997). The social worker as moral citizen: Ethics in action. *Social Work*, 42(3), 223-230.
- Matto, H. C., & Strolin-Goltzman, J. (2010). Integrating social neuroscience and social work: Innovations for advancing practice-based research. *Social Work*, 55(2), 147-156.
- McMahon, D. E. (2015). Neurofeedback in an integrative medical practice. In *Restoring the Brain: Neurofeedback as an Integrative Approach to Health* (pp. 95-116). <https://doi.org/10.1201/b18671>
- McMillan, T. M., & Wood, R. L. (2017). *Neurobehavioural disability and social handicap following traumatic brain injury, second edition*. <https://doi.org/10.4324/9781315684710>
- Memorial University School of Social Work. (2015). *Vision, Mission and Values*. Memorial University School of Social Work. Retrieved August 11, 2020 from <http://www.mun.ca/socwrk/home/vision.php>
- Mikelatou, A., & Arvanitis, E. (2018). Social inclusion and active citizenship under the prism of neoliberalism: A critical analysis of the European Union's discourse of lifelong learning. *Educational Philosophy and Theory*, 50(5), 499-509.
- Montgomery, A. (2013, 2013/09/01). Toward The Integration of Neuroscience and Clinical Social Work. *Journal of Social Work Practice*, 27(3), 333-339. <https://doi.org/10.1080/02650533.2013.818947>
- Morein-Zamir, S., & Sahakian, B. J. (2010). Neuroethics and public engagement training needed for neuroscientists. *Trends in cognitive sciences*, 14(2), 49-51.
- NASW Press. (2015). *Policy Statement Topic Areas Social Work Speaks 10th Edition—NASW Policy Statements*. NASW Press. Retrieved August 11, 2020 from <https://www.naswpress.org/publications/practice/inside/speaks-topic-areas.html>
- Nijboer, F., Clausen, J., Allison, B., & Haselager, P. (2013, 2011/08/01). The Asilomar Survey: Stakeholders' Opinions on Ethical Issues Related to Brain-Computer Interfacing. *Neuroethics*, 6(3), 541-578. <https://doi.org/10.1007/s12152-011-9132-6>
- Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy*, 39(6), 751-760.
- Page, S., Hope, K., Maj, C., Mathew, J., & Bee, P. (2012). 'Doing things differently'-working towards distributed responsibility within memory assessment services [Article]. *International Journal of Geriatric Psychiatry*, 27(3), 280-285. <https://doi.org/10.1002/gps.2716>
- Penz, K. L., & Bassendowski, S. L. (2006). Evidence-based nursing in clinical practice: implications for nurse educators. *The Journal of Continuing Education in Nursing*, 37(6), 250-254.
- Petruik, C. R., Freeman, V. E., McGillicuddy, P., & Dimitropoulos, G. (2017). Perceptions of health care social workers in Ontario: challenges and facilitators to reflective practice. *Reflective Practice*, 18(3), 339-357.
- Pozzer, L. L., & Jackson, P. A. (2015). Conceptualizing Identity in Science Education Research: Theoretical and Methodological Issues. In *Sociocultural Studies and Implications for Science Education* (pp. 213-230). Springer.
- Pray, J. L., & Jordan, I. K. (2010). The deaf community and culture at a crossroads: Issues and challenges. *Journal of Social Work in Disability and Rehabilitation*, 9(2), 168-193. <https://doi.org/10.1080/1536710X.2010.493486>
- Pray, K. (1945). *Social work and social action*. Virginia Commonwealth University. Retrieved August 11, 2020 from <https://socialwelfare.library.vcu.edu/social-work/social-work-and-social-action-1945/>
- Raitakari, S., Juhila, K., & Räsänen, J.-M. (2019). Responsibilities, social work and inclusive social security in Finland. *European Journal of Social Work*, 22(2), 264-276.
- Roskies, A. (2002). Neuroethics for the new

- millenium. *Neuron*, 35(1), 21-23.
- Shapiro, J. R., & Applegate, J. S. (2000). Cognitive neuroscience, neurobiology and affect regulation: Implications for clinical social work. *Clinical Social Work Journal*, 28(1), 9-3.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63-75.
- Sherwin, S. (2011). Looking Backwards, Looking Forward: Hope for Bioethics' Next Twenty Five Years. *Bioethics*, 25(2), 75-82.
- Social Work Action Network. (2010). *Social work and social justice: a manifesto for a new engaged practice*. Paisley: SWAN. Retrieved August 11, 2020 from <https://socialworkfuture.org/manifesto-2004-the-foundations-of-swan/>
- Stahl, B. C., Timmermans, J., & Flick, C. (2016). Ethics of Emerging Information and Communication Technologies On the implementation of responsible research and innovation. *Science and Public Policy*, 44(3), 369-381. <https://doi.org/10.1093/scipol/scw069>
- Stanford, S. N. (2011). Constructing moral responses to risk: A framework for hopeful social work practice. *British Journal of Social Work*, 41(8), 1514--1531. <https://doi.org/10.1093/bjsw/bcr030>.
- Stankus, T. (2008). Can the brain be trained? Comparing the literature on the use of EEG biofeedback/neurofeedback as an alternative or complementary therapy for attention deficit hyperactivity disorder (ADHD) [Article]. *Behavioral and Social Sciences Librarian*, 26(4), 20-56. <https://doi.org/10.1080/01639260802031556>
- Thursz, D. (1966). Social action as a professional responsibility. *Social Work*, 11(3), 12-21.
- Tobin, K. (2009, 2009). Tuning into others' voices: radical listening, learning from difference, and escaping oppression. *Cultural Studies of Science Education*, 4(3), 505-511.
- Todt, O. (2011). The limits of policy: Public acceptance and the reform of science and technology governance. *Technological Forecasting and Social Change*, 78(6), 902-909. <https://doi.org/10.1016/j.techfore.2011.02.007>
- Toumey, C. (2011). Democratizing nanotech, then and now. *Nat Nano*, 6(10), 605-606. <https://doi.org/10.1038/nnano.2011.168>
- Trahan, M. H., Smith, K. S., Traylor, A. C., Washburn, M., Moore, N., & Mancillas, A. (2019). Three-dimensional virtual reality: Applications to the 12 grand challenges of social work. *Journal of Technology in Human Services*, 37(1), 13-31. <https://doi.org/10.1080/15228835.2019.1599765>
- Ulrich, W. (2003). *A brief introduction to critical systems thinking for professionals and citizens*. Ulrich. Retrieved August 11, 2020 from https://wulrich.com/cst_brief.html
- Various. (2016). *Innovations in the treatment of substance addiction* (A. L. M. Andrade & D. De Micheli, Eds.). Springer. <https://doi.org/10.1007/978-3-319-43172-7>
- Vidmar, T. (2014). New dimensions of understanding of lifelong learning from Antiquity to Comenius. *Review of European studies*, 6(3), 91.
- Villamil, V., Deloria, R., & Wolbring, G. (2019). Artificial Intelligence and Machine Learning: What is the role of social workers, occupational therapists, audiologists, nurses and speech language pathologists according to academic literature and Canadian newspaper coverage? REHAB '19: 5th Workshop on ICTs for improving Patients Rehabilitation Research Techniques, Popayán, Colombia 11-13th September. <https://10.1145/3364138.3364158>.
- Webster-Wright, A. (2009). Reframing Professional Development Through Understanding Authentic Professional Learning. *Review of educational research*, 79(2), 702-739. <https://doi.org/10.3102/0034654308330970>
- Wojtalik, J. A., Eack, S. M., Smith, M. J., & Keshavan, M. S. (2018). Using Cognitive Neuroscience to Improve Mental Health Treatment: A Comprehensive Review. *Journal of the Society for Social Work and Research*, 9(2), 223-260. <https://doi.org/10.1086/697566>
- Wolbring, G. (2010). Ableism and Favoritism for Abilities Governance, Ethics and Studies: New Tools for Nanoscale and Nanoscale enabled Science and Technology Governance. In S. Cozzens & J. M. Wetmore (Eds.), *The Year book of Nanotechnology in Society*, vol. II: *The Challenges of Equity and Equality* (pp. 89-104). Springer.
- Wolbring, G. (2012a). Ethical Theories and Dis

- courses through an Ability Expectations and Ableism Lens: The Case of Enhancement and Global Regulation. *Asian Bioethics Review*, 4(4), 293-309.
- Wolbring, G. (2012b). Nanotechnology for Democracy versus Democratization of Nanotechnology. In H. v. Lente, C. Coenen, T. Fleischer, K. Konrad, L. Krabbenborg, C. Milburn, & F. Thoreau (Eds.), *Little by Little: Expansions of Nanoscience and Emerging Technologies* (pp. 89-105). AKA-Verlag/IOS Press.
- Wolbring, G., & Diep, L. (2014). Engaging with technology governance in social work education: An essential for preparing future social work(ers). *Professional Development: International Journal of Continuing Social Work Education*, 17(2), 63-75.
- Wolbring, G., & Diep, L. (2016). The Discussions around Precision Genetic Engineering: Role of and Impact on Disabled People. *Laws*, 5(3), Article 37.
- Yates, L. A., Yates, J., Orrell, M., Spector, A., & Woods, B. (2017). *Cognitive stimulation therapy for dementia: History, evolution and internationalism*. Routledge. <https://doi.org/10.4324/9781315209043>
- Yorke, J., & Bergère, T. (2018). Where the rubber hits the road: Neuroscience and social work. *Social Work in Health Care*, 57(2), 79-94. <https://doi.org/10.1080/00981389.2017.1407861>