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Inclusion and accessibility in STEM education: Navigating the duty to accommodate and disability rights

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Abstract: The duty to accommodate is a fundamental legal concept embedded in Canadian human rights law. The concept itself makes a contribution to advancing the goals of human rights law by attempting to extend the right to equality by protecting people from discrimination. In post-secondary institutions, pursuant to human rights legislation, the duty to accommodate requires that educators and administrators should attempt to accommodate students with disabilities short of undue hardship. Despite these legal requirements, students with disabilities are often underrepresented in STEM (science, technology, mathematics and engineering) disciplines because they face multiple barriers to accessing reasonable accommodation within the classroom and laboratory environments in Canadian universities (Sukhai and Mohler, 2017, Sukhai et al, 2014).

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Inclusion and accessibility in STEM education: Navigating the duty to accommodate and disability rights

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INTRODUCTION:

"Intelligence is the ability to adapt to change" –Stephen Hawking (1942-2018)[3]

The duty to accommodate is a fundamental legal concept embedded in Canadian human rights law. The concept itself makes a contribution to advancing the goals of human rights law by attempting to extend the right to equality by protecting people from discrimination. In post-secondary institutions, pursuant to human rights legislation, the duty to accommodate requires that educators and administrators should attempt to accommodate students with disabilities short of undue hardship. As human rights law and disability rights evolve, tensions arise amongst the judiciary, universities, students, administrators, faculty and staff regarding the application of reasonable accommodation and undue hardship in the universities, and who should bear the costs of the accommodation (Joffe and Lattanzio, 2010).

Despite these legal requirements, students with disabilities are often underrepresented in STEM (science, technology, mathematics and engineering) disciplines because they face multiple barriers to accessing reasonable accommodation within the classroom and laboratory environments in Canadian universities (Sukhai and Mohler, 2017, Sukhai et al, 2014). Students

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[3] Hawking, S. (1988). *A Brief History of Time*. New York: Bantam Books, appendix.

with disabilities are often unable to participate and engage in real-life experiments in lab-based science curriculum. For instance, in Chemistry Labs, students with disabilities may require a retro-fitted design of the lab space along with individualized accommodations (Sukhai et al., 2014; Etkin 2016). Given the lack of resources, mentorship and faculty supports, students with disabilities in STEM disciplines further experience attitudinal and systemic barriers to receiving appropriate accommodations (National Educational Association of Disabled Students, 2010). Since this is a grey area of law, educators are often unsure of how to apply the legal requirements of the duty to accommodate appropriately for students pursuing STEM, while balancing the factors of health, safety and cost (*Nova Scotia (Workers' Compensation Board) v. Martin; Nova Scotia (Workers' Compensation Board) v. Laseur*, 2003).

There is an absence of fully accessible science education classrooms and labs in Canada. Further, the research on this topic in the Canadian context is limited, specifically regarding the duty to accommodate and reasonable accommodation for students disabilities in STEM, science education, laboratories, and lab-based fields (Sukhai and Mohler, 2017; Sukhai et al., 2014; National Educational Association of Disabled Students, 2010; Etkin 2016). Thus, the significance of this study lies in ensuring reasonable accommodation for students with disabilities in science education. We hope this research can assist educators to create and implement inclusive and accessible science classrooms and labs in Canada. This paper recognizes the principles of diversity and disability of universal design and reasonable accommodation for all.

Drawing from interdisciplinary research in STEM education, disability law, disability theory and disability rights, [4] this paper analyzes the following questions:

1) What barriers do students with disabilities in STEM face in Canada's post-secondary institutions?
2) What does the law require in regard to reasonable accommodation, inclusion and accessibility in STEM?
3) Are disability laws working to support and accommodate students with disabilities within STEM disciplines in post-secondary institutions?
4) What can all stakeholders practically do to ensure that students with disabilities in STEM are appropriately accommodated in science education in regard to factors such as health, safety and cost?
5) What inclusive teaching practices and pedagogy should educators adopt to accommodate students with disabilities in STEM to ensure that they obtain equality of access and first-hand appropriate experience?

This paper analyzes Canada's legal obligations that stipulate the requirements to ensure full inclusion and accessibility for STEM within post-secondary institutions. By examining science education research, chemistry education research, disability theory, key cases, human rights legislation, the *United Nations Convention on the Rights of Person with Disabilities* and Canada's new proposed accessibility legislation, this paper suggests that there is an evident disconnect between the conceptualization of the law and its implementation by post-secondary institutions. We question whether disability laws are actually working to ensure students with disabilities are accommodated in post-secondary institutions. In order to facilitate the delivery of inclusive and accessible classrooms and labs in science education as required by the law, this paper advocates for various policy, pedagogical and theoretical approaches to be employed by faculty, administrators, staff and mentors.

[4] We have developed a unique partnership in Law and Science, which has enabled us to have access to interdisciplinary research, expertise and resources in both disciplines.

This paper draws from current research and advocacy by the authors on behalf of students with disabilities. Further, this research has been enriched by the subject matter experts who shared their time, experiences and expertise with us including the following: people with disabilities in STEM, chemists, scientists, educators, administrators, deans of science, chairs of departments at post-secondary institutions, lawyers specializing in disability and human rights law; service providers working at disability and advocacy organizations for people with disabilities and leading researchers developing accessible classrooms labs for STEM post-secondary curriculum in Canada (Thompson Rivers University, University of Toronto, University of Manitoba, York University, University of British Columbia, McMaster University) and the United States (University of California, Berkeley, Purdue University and Georgia Institute of Technology).

BARRIERS TO INCLUSION AND ACCESSIBILITY IN STEM

Statistics Canada reports that there are approximately 3.8 million people in Canada who have self-reported to be living with a disability in Canada (Statistics Canada, 2015). Approximately 14% of Canadians with disabilities (between 25-64) obtain a university degree (bachelor's or higher) (Statistics Canada, 2015). In Ontario, it is estimated that between 10-15% of students in post-secondary education institutions will require the assistance of disability services offices (McCloy and DeClou, 2013) Unfortunately, there appear to be no statistics on the number of students with disabilities pursuing STEM fields in Canada's post-secondary institutions (National Educational Association of Disabled Students, 2010).

Students with disabilities in STEM face disabling barriers that prevent them from fully participating and succeeding in post-secondary institutions. The following barriers are frequently

highlighted within the literature resulting in a lack of increased representation of students with disabilities within STEM:

- diminished support systems after secondary (students entering lab-based courses may not be aware of available supports in their university, or the supports simply may not be available);
- lack of awareness of successful role models (students may not be aware that there are, indeed, successful scientists with disabilities from whom they can learn);
- lack of access to technologies (students may not have access to the required assistive technology that would enable them to take part in lab activities);
- poor self-advocacy skills on the part of students;
- inadequate accommodations; and
- low expectations from faculty (Hilliard et al. 2011, pg 45; also see Sukhai et al., 2014, pg. 6; Sukhai and Mohler, 2017, pg. 27).

Given the lack of accessible laboratories in Canadian post-secondary institutions, students face multiple barriers to participate in lab-based STEM disciplines. For students with mobility issues, science labs are "encumbered by high workbenches, inaccessible cabinets, and overcrowded fragile equipment" including "faucets for sinks, gas hookups, power outlets, fume hoods and safety cabinets, eye wash stations and other safety equipment" (Sukhai et al., 2014, pg. 6; also see Hilliard et al. 2011). In an empirical study conducted at McMaster University, a student with a disability stated as follows: "I can't handle three hour labs, that is why I didn't go into the hard-core sciences" (Marquis et al., 2016, pg. 56). Consequently, research suggests that students with disabilities are often discouraged and dissuaded from pursuing STEM based fields in Canada's post-secondary institutions in the first place (Marquis et al., 2016; Hilliard et al. 2011).

The primary barrier to inclusion and accessibility for students with disabilities in post-secondary institutions within STEM disciplines is attitudinal (Sweet, 2018). For instance, students with mental health disabilities are often stigmatized in Chemistry as they "feel as though others think they are faking or dramatizing a condition." (Sweet, 2018, pg. 69). A study

conducted by the National Educational Association of Disabled Students in Canada suggests that the "attitudinal barriers take a variety of forms, including ignorance, misperceptions, stigma, discrimination, and stereotyping" (National Educational Association of Disabled Students, 2010, pg. 28). The study found that there was often "ignorance and misperceptions around the science and technology-related capabilities of people with disabilities" (National Educational Association of Disabled Students, 2010, pg. 28). For instance, an informant in the study suggests "academic advisers direct people with disabilities to lower capacity jobs due to stigma and preconceived notions" (National Educational Association of Disabled Students, 2010, pg. 29).

Unlike in the American context, there appears to be no statistics available in Canada on the number of scientists with disabilities in STEM careers (National Educational Association of Disabled Students, 2010). Further, there are no robust funding sources to ensure that Canadian labs and classrooms are accessible and inclusive. As a result, students with disabilities pursuing STEM often lack mentorship and support. This is particularly evident as there continues to be a lack of awareness regarding the process of receiving appropriate accommodations. Students with disabilities must self-advocate to attain appropriate accommodations as the duty to accommodate requires students initiate the process to receive accommodation. This process can be daunting for students, particularly given the lack of resources, the knowledge gap and indifference amongst faculty instructing students with disabilities, the lack of STEM appropriate accommodations, the requirements of full-time study (which is often not reasonable for students with disabilities) and the intersecting systemic and attitudinal barriers (National Educational Association of Disabled Students, 2010; Marquis et al., 2016).

Despite the affirmative legal obligations to ensure universities do accommodate students with disabilities in STEM, we argue that students with disabilities continue to face barriers to

receiving appropriate accommodations and may discontinue in STEM as a result. As exemplified in latter sections of this paper, there is an increasing number of students with disabilities in STEM who do not receive appropriate accommodations unless they threaten and ultimately are forced to pursue legal actions through filing Human Rights Complaints in accordance with human rights legislation. Consequently, it is evident that "there is a broader failure [for post-secondary institutions] to acknowledge the ableist norms that inform teaching and learning innovation" (Marquis et al., 2016, pg. 55). Thus, faculty, administrators, staff and mentors must be equipped to ensure that students with disabilities are appropriately accommodated within STEM labs and classrooms.

DISABILITY THEORY

Drawing from disability theory, we recognize how issues of accessibility and inclusion in science education within Canada's post-secondary institutions have been shaped by various theoretical perspectives (Titchkosky, 2011). This paper uses the social model or human rights model to "recognize that it is society's failure to accommodate the needs of people with disabilities, not some inherent mental or physical condition, which gives rise to the 'disabling disadvantage' that people with disabilities encounter in their daily lives" (ARCH Disability Law Centre, 2013, pg. 5; also see Pothier, 1992; Oliver, 1990; Davis, 1997; Bickenbach, 1993).

Interestingly, both the *United Nations Convention on the Rights of Persons with Disabilities* and the Supreme Court of Canada have recognized and favored the social model approach to conceptualizing disability rights (*Convention on the Rights of Persons with Disabilities,* 2006; *Granovsky v. Canada (Minister of Employment and Immigration)*, [2000] 1 S.C.R. 703, 2000 SCC 28). Disability is viewed as "an evolving concept" that is socially

constructed (ARCH Disability Law Centre 2013, pg. 3; *Convention on the Rights of Persons with Disabilities,* 2006). In contrast, the medical model defines disability as an impairment, a problem, illness or deficiency that requires medical intervention (ARCH Disability Law Centre, 2013; Pothier, 1992). An analysis of various accommodation policies across Canadian post-secondary institutions suggests that most post-secondary institutions operate within the medical model of disability. Instead of actively creating a "culture of accessibility," accommodations are often only provided on the basis of formal diagnosis and medical evidence (Sukhai and Mohler, 2017, pg. 12).

THE HUMAN RIGHTS LEGAL FRAMEWORK: CURRENT ISSUES AND TRENDS

In the context of STEM, human rights legislation, which is quasi-constitutional, protects persons with disabilities from discrimination. Provincial *Human Rights Codes* recognize the right to equal access to education without discrimination. Disability is a prohibited ground and, therefore, discrimination is not permissible as per provincial *Human Rights Codes* and the *Canadian Charter of Rights and Freedoms* (Canadian Charter, 1982, s. 15). Human rights legislation requires students have a "right to equal education" regardless of whether they are attending public or private post-secondary institutions. (*Ontario Human Rights Code,* s. 1; Ontario Human Rights Commission, 2004). Thus, the duty to accommodate pursuant to common law and provincial *Human Rights Codes* requires post-secondary institutions to accommodate students with disabilities until undue hardship. Courts and tribunals use the following factors to assess whether undue hardship has been met: cost, external sources of funding if any, health and safety requirements (Ontario Human Rights Commission, 2018, para. 1; British Columbia Human Rights Clinic, 2018).

In Ontario, the government enacted the *Accessibility for Ontarians with Disabilities Act* (AODA) in 2005 to ensure that public organizations (including all post-secondary institutions) remove barriers to accessibility for people with disabilities (*Accessibility for Ontarians with Disabilities Act*, 2005). The relevant standards for this study include the Customer Service Standard (addressing accessibility for in regard to goods and services) and the Integrated Accessibility Standards (such as information and communications regulations; educational training for educators to create accessibility in course design and delivery) (*Accessibility for Ontarians with Disabilities Act*, 2005, S.O. 2005, c. 11, regulations). Critics argue the AODA has had limited impact upon the experiences of students with disabilities in Ontario's post-secondary institutions (Marqis et al., 2016; Flaherty and Roussy, 2014).

Provincial human rights codes, the AODA and other human rights commitments are strengthened by Canada's obligations under the *United Nations Convention on the Rights of Persons with Disabilities* (CRPD), which Canada ratified in 2010 (*Convention on the Rights of Persons with Disabilities*, 2008). According to Article 24 of the CRPD, Canada should adopt a full inclusion model for all educational services, including post-secondary institutions as follows:

> States Parties recognize the right of persons with disabilities to education. With a view to realizing this right without discrimination and on the basis of equal opportunity, States Parties shall ensure an inclusive education system at all levels and lifelong learning directed to:
>
> a. The full development of human potential and sense of dignity and self-worth, and the strengthening of respect for human rights, fundamental freedoms and human diversity;
>
> b. The development by persons with disabilities of their personality, talents and creativity, as well as their mental and physical abilities, to their fullest potential;
>
> c. Enabling persons with disabilities to participate effectively in a free society (*Convention on the Rights of Persons with Disabilities* 2006, Article 24; Also, refer to *Convention on the Rights of Persons with Disabilities* 2006, Article 9 which specifically addresses "Accessibility").

It is important to note that the Minister of Sport and Persons with Disabilities has tabled Federal Accessibility Legislation entitled "An Accessible Canada Act" on June 20, 2018 (Bill C-81 2018). Although the legislation is still being deliberated and revised, the government must be applauded for putting forth unified federal legislation that is focused on eliminating the intersecting barriers faced by people with disabilities. We submit that the proposed legislation must implement and enforce the CRPD and ensure full inclusion and accessibility for students with disabilities in STEM within Canada's post-secondary institutions. Along with the proposed new federal accessibility legislation, the federal government should also work to adopt a National Strategy for Inclusive Education that specifically addresses barriers for students with disabilities in STEM.

Students with disabilities in STEM rely upon the described legal framework to obtain accommodation from post-secondary institutions. The process is triggered once a student with a disability has identified the need for accommodation and has initiated the process. In publicly funded post-secondary institutions, students contact Disability Services offices that provide supports and coordinate procedures for students with disabilities to receive accommodation (National Educational Association of Disabled Students, 2010). Pursuant to the specific protocols and guidelines within the institution, the process generally requires students to provide medical documentation from a health professional (physician, psychiatrist or psychologist) to describe the extent to which the student's disability interferes with academic performance and the recommended accommodations (Condra et al., 2015). The watershed case of *Dhanota v. York* University involved the extent of medical documentation required for a student to receive accommodation for her mental health disability (Ontario Human Rights Commission, 2016). In this case, Navi Dhanota argued that she should not have to reveal her mental health diagnosis

and other personal medical information to receive accommodation for her disability. The Ontario Human Rights Commission intervened in the case on behalf of Dhanota and the case was settled (Ontario Human Rights Commission, 2016).

Consequently, the Ontario Human Rights Commission created new documentation guidelines that eliminate the mandatory disclosure of mental health disability diagnosis to receive accommodations (Ontario Human Rights Commission, 2017). It is important to note that the guidelines and the case have precedent in Ontario and not elsewhere in the country. Thus, we argue that it should be enforced in all Canadian post-secondary institutions. As Dhanota herself argues:

> Removing the requirement to disclose a DSM diagnosis in order to access academic accommodations is an exciting step forward in the university's commitment to student success and their interpretation of (dis)ability. With this change, students will no longer be required to define their experiences using a psychiatric label. The majority of universities in Ontario have required students to disclose a DSM diagnosis before registering with their accommodation services. The Ontario Human Rights Commission's intervention in this case and York's commitment to change have created a landmark precedent which will change the understanding of accessibility and (dis)ability when receiving university accommodations. All students go to school to invest in their future and to succeed, and I believe this change will help them achieve this goal to the best of their ability (Ontario Human Rights Commission 2016, para. 5).

The Supreme Court of Canada (SCC) in *Nova Scotia (Workers' Compensation Board) v Martin* found that appropriate accommodations must be individualized with respect to one's circumstances, disability related-needs and abilities (*Nova Scotia (Workers' Compensation Board) v. Martin; Nova Scotia (Workers' Compensation Board) v. Laseur,* 2003). In their decision, the SCC, drawing from the social model of disability stated as follows: "no single accommodation or adaptation can serve the needs of all. Rather, persons with disabilities encounter additional limits when confronted with systems and social situations which assume or require a different set of abilities than the ones they possess" (*Nova Scotia (Workers'*

Compensation Board) v. Martin; Nova Scotia (Workers' Compensation Board) v. Laseur, 2003, para. 81).

The issue of "individualized accommodation" arose in *Tang v McMaster University* (*Tang v. McMaster University*, 2014). In this case, the applicant was a doctoral student pursuing a PhD in Medical Sciences Graduate Program. During his graduate work, Tang experienced a sports injury and post-concussive syndrome. Tang alleged that McMaster University failed to appropriately accommodate his disability related-needs and provide reasonable accommodation thereby breaching its *Human Rights Code* obligations. In particular, Tang requested that the comprehensive exam format be modified into an oral exam versus a written exam to accommodate his disability. The university denied his accommodation request and proceeded to only offer extra time to complete the written component of the exam. Consequently, Tang was forced to withdraw from McMaster University since his accommodations were arguably inappropriate and ineffective (*Tang v. McMaster University*, 2014).

Despite the strong evidentiary record and the support of ARCH Disability Law Centre and the Ontario Human Rights Commission, the Ontario Human Rights Tribunal was not persuaded by the evidence put forward on behalf of *Tang* (*Tang v. McMaster University*, 2014; *Tang v. McMaster University*, 2015). The Ontario Human Rights Tribunal found that there was no *prima facie discrimination* and McMaster University had not breached the *Human Rights Code*. In contrast to the SCC in *Nova Scotia (Workers' Compensation Board) v. Martin* and other cases, the Ontario Human Rights Tribunal denied Tang's accommodation request in favor of a less individualized approach to accommodation supporting the medical model of disability (*Nova Scotia (Workers' Compensation Board) v. Martin; Nova Scotia (Workers' Compensation Board) v. Laseur*, 2003; *Tang v. McMaster University*, 2014). The Human Rights Tribunal

indicated that there was a "lack of objective evidence indicating that persons with post-concussion syndrome similar to his suffer adverse impacts related to their disability when undergoing something like the comprehensive exam with the accommodations provided but without the ones the applicant wanted" (*Tang v. McMaster University*, 2014, para. 68). This case exemplifies the problematic nature of the medical model and the impact it can have for students with invisible or perceived disabilities, who are pursuing STEM in post-secondary institutions.

CREATING INCLUSION AND ACCESSIBILITY IN STEM: PRAGMATIC CONSIDERATIONS

> ***"[T]he right to education is in fact the right to inclusive education."*** (UN Human Rights Council, 2013, pg. 4)

We argue that despite the robust legal framework aimed at creating an inclusive and accessible education, there continues to be barriers for students with disabilities pursuing STEM in post-secondary institutions. Canadian human rights codes fail to create "positive obligations" which ensure inclusion and accessibility within post-secondary institutions (Flaherty and Roussy, 2014, p.8). Instead, the legislative framework sets up complaint procedures, mechanisms for accommodations if requested, and compensation in cases of discrimination (for past wrongs) (Flaherty and Roussy, 2014). As Flaherty and Roussy (2014) suggest, this leads to an "ad hoc enforcement of human rights," which is described as follows: "[T]he onus of asserting rights or identifying *Code* breaches rests with students. In a manner of speaking, this leads to an *ad hoc* enforcement of human rights, where only those who complain see their rights enforced. As a result, those students who lack the will, endurance, means or ability to lodge a formal complaint may continue to be victims of discrimination" (p. 8).

Consequently, the extent to which appropriate and effective accommodations are offered and implemented is often dependent on the educators' willingness to "create a culture of accessibility," by providing mentorship and supports throughout the accommodation processes (Sukhai and Mohler, 2017, p. 57-59; Zhang, 2010). We encourage faculty, staff, and administrators to actively participate in challenging the barriers for students with disabilities in STEM and engage in transformative change. Educators can adopt various teaching and pedagogical approaches as follows: engaging with disability services offices to provide supports; mentoring students with disabilities individually; adopting unconventional exam/testing methods; flexible deadlines; creating reading groups and learning groups; taking advantage of existing resources; participating in training and professional development on disability issues; creating self-advocacy trainings for students regarding accommodation and disability rights; encouraging STEM peer tutoring and creating internships for students with disabilities (Sukhai and Mohler, 2017; Zhang 2010).

Given the dearth of fully accessible and inclusive STEM learning environments, educators will often have the opportunity to create innovative and creative solutions themselves (Sukhai and Mohler, 2017; Sukhai et al., 2014; National Educational Association of Disabled Students, 2010; Etkin 2016). As highlighted by the Supreme Court of Canada in *Nova Scotia (Workers' Compensation Board)* v. *Martin*, accommodations measures should be individualized and monitored (*Nova Scotia (Workers' Compensation Board) v. Martin; Nova Scotia (Workers' Compensation Board) v. Laseur*, 2003). Since a student's disability-related needs may change, accommodations in STEM must be consistently examined, evaluated and modified, if necessary (*Nova Scotia (Workers' Compensation Board) v. Martin; Nova Scotia (Workers' Compensation Board) v. Laseur*, 2003). For instance, Harshman et al. examined and evaluated the extent to

which tactile representations of gas laws increased learning for students with blindness or low vision (2013). Reglinski's study indicated that pictoral depictions of chemistry concepts in exams were an effective accommodation for students with disabilities, particularly for those with learning disabilities (2014). Further, Lunsford and Bagerhugg were able to engage students with disabilities in chemistry laboratory experiences through workshop and peer-learning modules (Lunsford and Bagerhugg, 2006).

Along with individualized accommodations measures, we suggest educators draw from the Universal Design approach. The CRPD explicitly includes universal design, in order to comply Article 24, and describes the concept in Article 2 as follows:

> …the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed (*Convention on the Rights of Persons with Disabilities* 2006, Article 2).

In regard to factors such as health, safety and cost, there are many practical and pedagogical considerations drawing from the Universal design approaches that will create inclusive and accessible learning environments for students with disabilities in STEM. For STEM laboratories specifically, we recommend post-secondary institutions consider implementing the following:

- Adjustable height workstations and adjustable lab benches;
- Accessible, walk-in fume hoods that veer forward with exhaust flexible connections;
- Lower-level sinks and sensor activated sinks;
- Plastic beakers rather than glass beakers where appropriate;
- Weighted bases to use for microscopes;
- Wall phones; white boards; SMART boards; and enlarged screens;
- Accessible light switches located at the lowest level;
- Mirrors to assist students to view experiments and demonstrations;
- Power-assisted and accessible doorways;
- Open spaces for increasing inclusion, wellness and accessibility;

- Eyewash stations and emergency showers that are close and accessible to the workstation;
- Natural and artificial lighting sources;
- Assistive and adaptive technologies;
- Accessible pull-cord alarms;
- Accessible emergency devices (see National Educational Association of Disabled Students, 2014, pg 33; Sweet 2018; Sukhai and Mohler 2018, 33-34).

To challenge ableist norms, STEM departments should actively take into account the lived experiences of students with disabilities and adopt tenets of the social model of disability in policy reform. Post-secondary institutions should put more funding towards inclusive education, recruitment policies for equity-seeking communities and public legal education workshop training on the legal requirements of accommodation. A robust effort should be made to ensure there is an increased representation of faculty members with disabilities and ultimately, students with disabilities in STEM.

CONCLUSION

Given the paucity of research in this area, this paper analyzed the experiences of students with disabilities in STEM within Canada's post-secondary institutions vis-à-vis the legal requirements pursuant to domestic and international human rights laws. Through interdisciplinary research in STEM education, disability law, disability theory and disability rights, we analyzed the barriers students with disabilities in STEM face in accessing reasonable accommodation in post-secondary institutions. Further, we examined the applicable human rights legal framework; the extent to which disability laws are working; and practical considerations for educators to adopt to ensure that students with disabilities are appropriately accommodated in STEM education. To facilitate and create inclusion and accessibility in STEM as conceptualized by the law, we advocate for educators to actively engage in the process of creating individualized

accommodations that are appropriate for the students' disability-related needs. Universal design principles, as adopted by the *Convention on Rights of Persons with Disabilities* can assist post-secondary institutions in increasing learning outcomes and success for student with disabilities in STEM.

It must not be forgotten that many of the world's most famous scientists such as Albert Einstein, Stephen Hawking, Thomas Edison, Isaac Newton and Temple Grandin, were and are people with disabilities. Thus, it is imperative that we as educators participate in the transformative goal to create inclusive and accessible learning environments for students with disabilities in STEM, enabling them to realize their full potential as future leaders.

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