FOSTERING ACCESSIBLE LEARNING ENVIRONMENTS:

UNIVERSITY FACULTY ATTITUDES AND PRACTICES IN INCLUSIVE INSTRUCTION, AND RELATIONSHIP WITH FACULTY DEVELOPMENT

Boris Vukovic

Educational and Counselling Psychology

McGill University, Montreal

October 2016

A THESIS

Submitted to McGill University in partial fulfillment of the requirements of the degree of Doctor of Philosophy

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This study examined the characteristics of faculty attitudes and practices in inclusive instruction and their relationship with faculty development at Carleton University in Ottawa, Ontario. Survey data from a sample of 314 teaching faculty and course instructors were analyzed with the use of advanced inferential statistical methods. An additional sample was drawn for a pre-post analysis of a workshop's effectiveness in promoting attitudes and knowledge related to students with disabilities, accessibility in learning environments, and universal design in instruction. The findings demonstrate that faculty have overall positive attitudes and report comparable practices in inclusive instruction. Both general and disability-related faculty development activities promote these attitudes and practices. The workshop evaluated in the present study was effective in significantly increasing the endorsement of attitudes and knowledge related to several measures of inclusive instruction.

RÉSUMÉ

Cette étude examinait les caractéristiques des attitudes et des pratiques des professeurs dans l'enseignement inclusif, et leurs liens avec le développement du corps professoral de l'Université Carleton à Ottawa, Ontario. Les données d'enquête, d'un échantillon de 314 professeurs enseignants et de moniteurs de cours, ont été analysées avec l'aide de méthodes statistiques déductives avancées. Un échantillon supplémentaire a été établi pour une analyse pré-post de l'efficacité d'un atelier pour promouvoir les attitudes et les connaissances liées aux étudiants handicapés, l'accessibilité dans des environnements d'apprentissage, et la conception universelle dans l'enseignement. Les résultats démontrent que les enseignants ont des attitudes positives dans l'ensemble et signalent des pratiques comparables dans l'enseignement inclusif. Les activités générales et ceux liés au handicap du développement du corps professoral promouvoir ces attitudes et pratiques. L'atelier évalué dans l'étude actuelle était efficace pour augmenter de manière importante l'approbation des attitudes et des connaissances liées à un certain nombre de mesures d'enseignement inclusif.

ACKNOWLEDGMENTS

A number of individuals and departments have been instrumental in supporting my doctoral work, in particular in the later years following my return to full-time employment. I have been uniquely fortunate to have had Professor Alenoush Saroyan as my graduate supervisor and mentor. From my initial application to the then program of Instructional Psychology and throughout the many challenges encountered as a mature student with a job and a family, Professor Saroyan guided and motivated my work. It is as much a sheer fact as it is an expression of gratitude to state that this dissertation would not have been possible without her support. During a longer than usual timeframe of my doctoral studies, my family inspired me to keep going (and occasionally were a distraction). I am thankful for this to Aleksandra and Mila, my parents, my brother and his family. I am also grateful to my work colleagues at the Paul Menton Centre who have been supportive of my graduate studies through the many years (and occasionally were a distraction). My faculty development work at Carleton University, which provided the context for the study, has been done over the years in collaboration with the Educational Development Centre. I am thankful for their role in facilitating the workshops and the research project, and to the faculty who participated in both for their input and time. The dissertation itself benefited greatly from the feedback provided by my thesis committee members, Professors Alenoush Saroyan, Robert Bracewell, and Tara Flanagan, as well as the internal and external examiners, and members of the defence committee. It is submitted with a sense of relief, satisfaction, pride, and gratitude for having had the opportunity to complete my doctoral studies at McGill University.

INTRODUCTION

RESEARCH STUDY BACKGROUND

Persons with disabilities in Canada and the U.S. are participating in higher education more than ever before but at a rate significantly lower than persons without disabilities. In Canada, 13% of adults with disabilities have university degrees versus 20% for those without disabilities (Human Resources and Skills Development Canada, 2011), while in the United States the postsecondary enrollment gap between students with and without disabilities is 33.6% vs. 51.2%, respectively (Newman et al., 2011). This disparity is problematic in the age of knowledge economy, the need for skilled labour, and the increasing demand for a postsecondary degree as a minimum job competency. Such disparity also reflects the marginalizing of individuals with disabilities across various levels of social and economic participation, including higher education.

Even though the rate of increase in access to higher education for persons with disabilities is lagging behind that for persons without disabilities, we are seeing more and more students with disabilities attend college and university. Based on national university and college surveys in North America, we can expect over a million postsecondary students in an academic year to self-identify as having a disability, each of whom will require supports to fulfill their academic potential (Canadian University Survey Consortium, 2011; Canadian College Student Survey Consortium, 2009; Statistics Canada, 2011; Raue & Lewis, 2011; U.S. Government Accountability Office, 2009). One important pillar of support is higher education faculty who are uniquely positioned to facilitate accessible learning environments that reduce barriers to the

greatest extent possible toward a full participation and engagement of postsecondary students with disabilities.

Providing supports and accommodations to postsecondary students with disabilities is a legal obligation, in Canada and the U.S. The pressure to equip faculty with knowledge and tools to serve students with disabilities stems from policies at colleges and universities which are implemented in response to relevant laws, such as the Americans with Disabilities Act and the Section 504 in the U.S., and the provincial human rights statutes and disability acts in Canada. One unique example is the Accessibility for Ontarians with Disabilities Act (AODA), a comprehensive and proactive legislation in the province of Ontario, which as part of its legal standards requires postsecondary institutions to provide training to all of their educators in "accessible course delivery and instruction" (Ontario Gazette[1], 2011, Section 16.1).

However, our knowledge of how to assist faculty to successfully meet a very diverse spectrum of academic needs of postsecondary students with disabilities is limited. As discussed in the sections that follow, the limitation lies not in the availability of ideas and recommendations in the literature – such prescriptive, practice-oriented and theoretical literature is indeed comprehensive – but in the availability of evidence-based outcomes in disability-related faculty development. While we know that faculty value such activities and report many benefits, existing research is insufficient to demonstrate that disability-focused faculty development can influence faculty attitudes and practices regarding students with disabilities. In fact, we cannot state with certainty that disability-focused faculty development is any more effective than general faculty development in promoting attitudes and practices that support academic needs of

[1] The official publication of the Government of Ontario, in Ontario, Canada.

students with disabilities. We also have little understanding of what types of disability-related development activities are most effective for specific outcomes, for example whether workshops as a common type of faculty development in this area are effective in promoting attitudes and practices in inclusive instruction and universal design.

In addition to calling for clarification of the relationship between disability-related faculty development and faculty attitudes or practices, there is a need to clarify the very relationship between disability-related faculty attitudes and practices. As reviewed in the chapter that follows, there is research that suggests a discrepancy between faculty attitudes and practices in areas that relate to students with disabilities, such as inclusive instruction and universal design in education. These findings should be interpreted with caution and further investigated given the past research on the relationship between faculty espoused beliefs about teaching and their actual teaching practices (Kane, Sandretto, & Heath, 2002). It is important to examine in what specific areas, if any, discrepancies between attitudes and practices in inclusive instruction emerge. Such findings can then direct our faculty development efforts and our investigation of factors that hinder change in those instructional practices.

Lastly, the existing research in this area is in need of methodological rigour, as it is currently characterized by exploratory, descriptive, and practice-based case studies or program evaluation surveys. This important work has identified issues and relationships of interest; however, we now require more formal research designs and advanced methods to move the field toward evidence-based disability-related faculty development. The literature review below reveals that we currently do not have enough, or reliable enough, research evidence to justify significant

investment into faculty development focused on disability-related practices such as the universal design instructional models. This is in sharp contrast to the popularizing of such conceptual frameworks among disability service practitioners. The complexity of universal design and similar disability-focused instructional models and related faculty development require advanced research designs and methodologies to evaluate their effectiveness, which are lacking in the existing body of research in this area (Rao, Ok, & Bryant, 2014; Roberts, Park, Brown, & Cook, 2011). It should be noted that this state of research in disability-related faculty development may reflect methodological issues identified in education and psychology research more broadly (Keselman et al., 1998; Wilkinson, 1999).

The present research project is an effort to address the above concerns. It investigates the characteristics of university faculty attitudes and practices toward inclusive instruction and accessibility in teaching and learning. Furthermore, it examines relevant faculty development and evaluates the relationship with these attitudes and practices. This specific focus is localized in relation to the AODA requirement for educator training at Ontario universities in order to provide insight into various aspects of faculty development in inclusive instruction. The study uses a validated survey instrument to measure faculty attitudes and practices in inclusive instruction at Carleton University in Ottawa, Ontario, Canada. Advanced statistical analyses are employed to address methodological gaps in existing research on disability-related faculty development and provide examples of various analytical procedures that may be used in future research in this area. The application of procedures seldom used even within the broader educational research but otherwise recommended as methodological best practices is a deliberate objective in the current project. Their implementation is demonstrated within the context of

research questions familiar to our field in order to illustrate and encourage their use among education students and researchers. The overall aim of the study is then to explicate and expand upon the existing research findings, model rigorous statistical analyses, and inform faculty development initiatives in inclusive instruction and accessibility in teaching and learning. The results of this research-driven project are interpreted in relation to its major research questions and the research problem statement derived from the existing research base and literature. The interpretation of results is contextualized within the current state of higher education for students with disabilities and relevant legislative mandates such as the AODA.

CHAPTER I

LITERATURE REVIEW AND RESEARCH PROBLEM STATEMENT

Literature Review

This review takes a twofold approach to the literature on faculty development in higher education in areas of inclusive instruction and accessibility in teaching and learning. First, I review published studies on postsecondary faculty attitudes, knowledge, and practices toward students with disabilities in general, and those more specifically related to inclusive instruction and universal design instructional models. Second, I turn to examining research on faculty development and outcomes related to inclusive instruction and accessibility in teaching and learning in higher education.

Faculty attitudes, knowledge, and instructional practices. The literature on higher education faculty and students with disabilities is largely composed of descriptive studies and practice-oriented reports. Specifically, the majority of articles and reports focus on descriptions of various indices of postsecondary faculty attitudes, knowledge, and practices, based on self-report surveys. While such literature does not directly evaluate disability-related faculty development activities, it is worthwhile to include in the present review. Their findings and case reports provide insight into the areas in need of development, such as faculty perceptions of students with disabilities, their knowledge of disabilities or legal mandates, and their actual teaching practices.

Faculty in higher education demonstrate generally positive attitudes towards students with disabilities (Alghazo, 2008; Black, Weinberg, & Brodwin, 2014; Cook, Rumrill, & Tankersley, 2009; Gitlow, 2001; Rao, 2004), with some research indicating less favorable attitudes toward those with non-visible disabilities such as learning disabilities (LD), attention deficit hyperactivity disorder (ADHD), and psychiatric disabilities (Burgstahler & Doe, 2006; Hindes & Mather, 2007; Jensen, McCrary, Krampe, & Cooper, 2004; Sowers & Smith, 2004a). Female faculty show greater willingness to accommodate, more knowledge of disabilities, and greater willingness to support students with disabilities (Alliston, 2011; Cook et al., 2009; Leyser & Greenberger, 2008; Lombardi & Murray, 2011; Murray, Wren, & Keys, 2008). Faculty with knowledge about disabilities have more positive attitudes toward students with disabilities. Their knowledge is positively associated with interest in student disclosure and intention to provide accommodation (Bourke, Strehorn, & Silver, 2000; Murray, Wren, et al., 2008). Faculty attitudes are influenced by faculty affiliation – a number of studies have found that faculty members affiliated with Education hold more positive attitudes than faculty members from other disciplines; however, the findings are not consistent across disciplines and different research studies report on different sets of academic units (Alliston, 2011; Nelson, Dodd, & Smith, 1990; Rao & Gartin, 2003; Skinner, 2004). Instructors with lower academic rank are more willing to provide teaching accommodations than senior lecturers and professors, and report greater belief in the value of accommodations for student success (Bourke et al., 2000; Gitlow, 2001; Leyser, Greenberger, Sharoni, & Vogel, 2011; Lombardi & Murray, 2011). Faculty with more experience teaching students with disabilities have more positive attitudes toward students with disabilities and accommodations (Black et al., 2014; Leyser et al., 2003; Rao, 2004).

While faculty have positive attitudes toward students with disabilities, they are concerned about academic standards and are less willing to provide supports and accommodations which are perceived as either compromising those standards or as an unfair advantage in comparison to students who do not receive academic accommodations (Burgstahler & Doe, 2006; Hindes & Mather, 2007; Jensen et al., 2004; Leyser et al., 2003; Vasek, 2005). Others are concerned about extra workload and stress placed on them to adapt instruction, assessment, and classroom environment for students with disabilities (Hindes & Mather, 2007; Sowers & Smith, 2004a). There are also those who doubt the nature of the disability or the extent of functional limitations, question the legitimacy of the requested supports, or feel that students are misusing their disability status or diagnoses (Burgstahler & Doe, 2006; Jensen et al., 2004; Summers, 2008). These attitudes seem particularly strong in regards to students with non-visible disabilities, such as learning disabilities (Jensen et al., 2004). Lastly, a discrepancy has been observed between attitudes toward supporting students with disabilities and the actual practices implemented to support their needs (Leyser & Greenberger, 2008).

With respect to their knowledge about disabilities, faculty members identify gaps in information and understanding in the areas of disability characteristics, legal implications, and instructional strategies specific to the needs of students with disabilities (Brinckerhoff, McGuire, & Shaw, 2002; Burgstahler & Doe, 2006; Cook et al., 2009). Several studies show evidence that faculty members in higher education do not have a solid grasp of the legislations driving institutional policies on accommodations for students with disabilities (Katsiyannis, Zhang, Landmark, & Reber, 2009; Murray, Flannery, & Wren, 2008; Vasek, 2005; Vogel, Leyser, Burgstahler, Sligar, & Zecker, 2006), while some find that faculty have adequate knowledge in this area (Zhang et

al., 2010) or other skills related to accommodating students with disabilities (Leyser & Greenberger, 2008).

The students with disabilities express concern over what they perceive as mistreatment by faculty due to a lack of understanding of the nature and impact of disabilities on academic life and work, especially toward those with non-visible disabilities (Denhart, 2008; Jensen et al., 2004; Lehmann, Davies, & Laurin, 2000). Studies find that faculty with a higher degree of understanding and beliefs in the efficacy of accommodations show more willingness to provide accommodations such as alternative exam types or more time for assignments (Bourke et al., 2000; Zhang et al., 2010).

In addition to faculty attitudes and knowledge of disabilities, researchers and practitioners in this field are contributing to a growing body of literature on the topic of universal design (UD) applied to instruction, a paradigm imported into education from architecture, design fields, and engineering (Bowe, 2000). In these fields, universal design dictates a number of guidelines for making products and environments accessible to all users starting with users with disabilities (Center for Universal Design, 2011). The notion of universal accessibility for all users was taken up by disability educators and advocates to be applied to instructional practices, making educational experiences accessible to all, rather than retrofitting instruction or evaluation methods for students with disabilities through accommodations and alternative coursework (McGuire, Scott, & Shaw, 2003). Many practice-oriented models have emerged from different groups and institutions, expanding on the idea of universal design applied to instruction – two can be singled out as representative of this group: Universal Design of Instruction (UDI)

(Burgstahler, 2001; Scott, McGuire, & Shaw, 2003; Silver, Bourke, & Strehorn, 1998), and Universal Design for Learning (UDL) (Rose, Harbour, Johnston, Daley, & Abarbanell, 2008; National Center on Universal Design for Learning, 2011).

The UDI model is a more direct translation of the original universal design concept, with seven principles which present guidelines for instruction and course delivery (Burgstahler, 2001):

(1) fairness and equitable use in design of instruction;
(2) flexibility in participation and presentation;
(3) simple and consistent course design;
(4) readily perceived information;
(5) tolerance for error and supportive learning environment;
(6) minimal need for unnecessary physical effort;
(7) learning spaces that accommodate needs of the student and the instructional requirements.

In contrast, UDL is organized around three principles which, according to lead authors, are based in neuroscience research and which outline what educators need to consider in order to make learning accessible to the greatest number of students (Rose & Meyer, 2006):

(1) multiple means of representation;
(2) multiple means of action and expression;
(3) multiple means of engagement.

Research on universal design (UD) as applied to instructional practices is problematic. One review has looked at various instructional practices considered to be aligned with Universal

Design for Learning (UDL) (Orr & Hammig, 2009). Thirty eight quantitative and qualitative research studies were selected for review, published between 1991 and 2008, with the goal of identifying "research-based recommendations for inclusive pedagogy, exploring each within the context of universal design theories in the postsecondary setting" (p. 183). The authors identified five themes, each highlighting research data in support of practices reflecting the principles of universal design in instruction:

(a) backward design (course design starting with learning objectives and goals);

(b) multiple means of presentation (flexibility in presentation of course content);

(c) inclusive teaching strategies and learner supports (variety of lecture supports, study aids, writing assistance, and learning strategy instruction);

(d) inclusive assessment (flexible and alternative assessment methods); and

(e) instructor approachability and empathy (promoting student engagement and motivation).

The majority of research data reviewed by Orr and Hammig (2009) was based on student self-reports, several studies provided correlational evidence, and two studies used experimental methods to determine student outcomes. While this review provides valuable information about instructional practices benefiting students with learning disabilities, the selected studies do not share a common theoretical framework and many of them were not designed specifically to conform to the assumptions of universal design instructional models. This, however, is not an indication of a flawed methodology on the part of the authors of the review – on the contrary, the authors performed a comprehensive and methodical search of the relevant literature – but it is an indication of a nascent and scattered body of work on implementation of universal design in

education with a number of different theoretical iterations and inadequate research support, a state acknowledged by the authors themselves and other writers in the field (Edyburn, 2010; Orr & Hammig, 2009).

An illustrative example of the type of research studies on the effectiveness of universal design in higher education is one of the few studies carried out in the Canadian postsecondary context. Kumar and Wideman (2014) report on a case study of a university-level undergraduate course which implemented strategies related to the principles of UDL. The course instructor incorporated various options with respect to presentation of materials and information, and evaluation methods, as well as making efforts at engaging students in different ways, in person and online. The strategies used in the course are reported by the authors as representing the three major conceptual areas of UDL: Multiple Means of Representation, Expression, and Engagement. The degree of alignment with the UDL framework was not established in a formal manner, which is characteristic of research in this area as methods for evaluation of implementation of guidelines or overall models do not exist. The outcomes of the study were reported as related to the experiences of the course instructor and the students, assessed with an informal survey and a small number of follow-up interviews. The students indicated the various options in the course helped reduce stress by allowing them more control and decisions in selecting materials, assignment types, assignment weights, and due dates. The course instructor reported that efforts to incorporate UDL guidelines helped view course topics and the teaching approach from different perspectives, have more insight into student learning experiences, and be more engaged in teaching, even though these resulted in experiencing an increase in workload.

Research on faculty awareness and endorsement of instructional practices recommended by universal design models shows that faculty consider such practices very important (Cook et al., 2009; Lombardi, Murray, & Gerdes, 2011). However, endorsement of those instructional practices does not imply endorsement of the UD models per se, as many of those practices are not unique to UD models. As an example, the study by Black et al. (2014) reported faculty use of techniques the authors identified as deriving from universal design principles, but at the same time the study found the same faculty had in fact a very low level of familiarity with the concept of universal design. The point is often made about universally designed instruction that it is fundamentally about sound pedagogical practices for all students, or simply good teaching (Hatfield, 2003; Shaw, 2011; Edyburn, 2010). As evident from Orr and Hammig's (2009) themes, many instructional practices identified as UD can also be found in other progressive pedagogical models and guidelines.

In addition to endorsement of the universal design ideas, faculty report high levels of intended change toward incorporating the principles of universal design (Milligan, 2010). Even though faculty endorse the pedagogical recommendations from universal design frameworks and show intention to incorporate those recommendations, they also report low rates of actual implementation (Cook et al., 2009; Lombardi et al., 2011). A number of studies identify the need for training in inclusive teaching practices as a high priority for faculty, with particular focus on the principles of universal design in instruction (Izzo, Murray, & Novak, 2008; Vogel et al., 2006; Vogel, Holt, Sligar, & Leake, 2008; Wilson, Getzel, & Brown, 2000).

Research on faculty development and outcomes. The literature on disability-related faculty development and research outcomes of such initiatives directly informs the research questions in the present study, but the existing research base in this area is far more modest compared to existing research on faculty attitudes, knowledge, and practices.

U.S. demonstration projects. The main impetus for a number of research projects on disability-related faculty development in recent years originated with the funding from the U.S. Office of Postsecondary Education. First approved in 1999, the funding was renewed in 2008 until it was terminated in the fiscal year 2011 with a total over $70 million awarded to 94 projects. Titled Demonstration Projects to Support Faculty, Staff, and Administrators in Educating Students with Disabilities, the grants were awarded to "develop innovative, effective, and efficient teaching methods and other strategies to enhance the skills and abilities of postsecondary faculty and administrators in working with disabled students" (U.S. Department of Education, 2011a, para. 2).

Murray, Wren, Stevens, and Keys (2009) performed a search of the professional literature on the Demonstration Projects and found peer-reviewed articles for only four projects that focused on faculty development. A search performed for the present study to account for the period following Murray, Wren, et al.'s (2009) article, yielded a total of seven articles, including Murray, Wren, et al. (2009) about their own demonstration project. Three demonstration project articles were excluded since the focus was not strictly on faculty development interventions. Hence, only four research articles originating from the work funded under the Demonstration

Projects remained (Cook et al., 2006; Sowers & Smith, 2004b; Rohland et al., 2003; Murray, Wren, et al., 2009).

The research outcomes of those four research projects consist of faculty self-reports on the effectiveness of project activities. Activities included a summer institute with resource supports, direct training, and a student-faculty partnership (Cook et al., 2006); a training session with pre and post surveys (Sowers & Smith, 2004b); a faculty mentor training program (Rohland et al., 2003); and, a train-the-trainer summer institute (Murray, Wren, et al., 2009). In all four studies, faculty reported positive effect of the activities on their attitudes, knowledge, and perceptions of students with disabilities (Murray, Wren, et al., 2009), their ability to interact with students with disabilities (Cook et al., 2006), to believe that students with disabilities can be successful nursing practitioners (Sowers & Smith, 2004b), and to serve as mentors to other faculty (Rohland et al., 2003).

Apart from the Demonstration Projects, the same funding source jumpstarted two projects which became leading models in universal design of instruction and have since generated a considerable body of literature including some research studies discussed in the previous section on UD in instruction and in the section below on research outcomes (Burgstahler & Doe, 2006; Burgstahler & Cory, 2008; Madaus, Scott, & McGuire, 2003a, 2003b; McGuire, 2011).

In addition to outcomes reported by individual studies, the U.S. Office of Postsecondary Education set out overall outcome measures for the funding program. The Department's website only provides a summary of the performance indicators for the year 2006-2007, as follows:

- The percentage of faculty trained through project activities that incorporate elements of their training into their classroom teaching exceeded targets in the 2006-07 school years. (94 percent, target was 88 percent).
- Students with documented disabilities complete courses taught by faculty trained through project activities at a higher rate than students with no documented disabilities. The rate difference was lower than the 2006-07 school year target, demonstrating better than expected performance.
- Overall the program is performing better than the established target goals. (U.S. Department of Education, 2011b, p. 1).

Characteristics of faculty development activities. Aside from the Demonstration Projects, a number of other studies focused on disability-related faculty development. The majority consisted of surveys reporting descriptive information about faculty initiatives and participant feedback. These will be reviewed first. A much smaller number of studies employed more formal research designs to measure outcomes of faculty development activities, and will be reviewed last.

Large proportions of faculty report having received no disability-related training (Leyser & Greenberger, 2008). From those that have received training, we learn that training activities such as workshops, seminars, or courses are the most commonly recommended forms of faculty development by faculty themselves, and have been found to be more strongly associated with positive perceptions and attitudes than other forms of training (Murray, Lombardi, & Wren,

2011; Summers, 2008). Faculty prefer brief training sessions with varied activities, in-person, hands-on training delivered by other faculty and with student panels or case studies, opportunities for peer-to-peer training, and one-on-one support from disability service office (DSO) staff (Burgstahler & Doe, 2006; Cook et al., 2009; Debrand & Salzberg, 2004; Leyser et al., 2011; Vogel et al., 2006). In addition to traditional on-site training, most faculty express interest in the use of online environments for reference information and resources (Burgstahler & Doe, 2006; Vogel et al., 2008). Past reviews of best practices for faculty training emphasized a developmental process approach that engages faculty at various levels (Scott & Gregg, 2000).

With respect to the content, faculty want coverage of disability characteristics, legal rights and responsibilities, how accommodations are determined and documented, what strategies and technologies are used, and what instructional procedures are effective according to research on specific disabilities (Cook et al., 2009; Getzel, Briel, & McManus, 2003). Comprehensive reference information, relevant resources and supports, and most importantly, varied training activities, are commonly identified by faculty in higher education (Cook et al., 2009; Murray et al., 2011; Shaw & Scott, 2003). It has also been suggested that training be focused on specific issues, such as implications of legal requirements, rather than general attitudes and concepts (Cook et al., 2009).

Other professionals contributing to faculty development, such as faculty developers, DSO directors and staff, learning technologists, and institutional administrators believe programs should accommodate faculty learning needs and preferences, as well as their time, and foster partnership building in program design and feedback among all campus stakeholders

(Ambrosino, 2007). DSO staff and faculty also agree on the importance of the coverage of legal responsibilities and accommodations (Debrand & Salzberg, 2004; Salzberg et al., 2002). While DSO staff consider participation of DSO professionals in faculty training to be highly important, some faculty indicate preference for training delivered by other faculty members (Cook, 2007). The contact with the DSO staff is considered important, albeit in a one-on-one, just-in-time consultative capacity (Burgstahler & Doe, 2006; Cook, 2007). Although limited to one study, DSO directors did not rate student panels as a highly important component of faculty training while faculty repeatedly identified student participation as important addition to development activities (Burgstahler & Doe, 2006; Cook et al., 2009; Debrand & Salzberg, 2004; Vogel et al., 2008).

Student focus groups have provided input on what they believe to be best practices among faculty with regard to postsecondary students with disabilities. In one study across three different postsecondary institutions, students identified three common recommendations for the faculty: clear and straightforward expectations in courses, engagement with students in class, and sensitivity to student needs (Madaus et al., 2003a). Students define effective instructors as being approachable and available, clear in delivery of content, and engaging and challenging. Conversely, lack of clarity and consistency in course delivery are seen as the greatest obstacle to learning. Overall students identify barriers to learning as being more directly the result of instructional practices than faculty's willingness to provide accommodations (Madaus et al., 2003a). This is significant considering that currently accommodations are the main means of support for students with disabilities in colleges and universities, whereas the premise of inclusive instructional practices is that increased instructional access for students with disabilities

will reduce the need for accommodations (Ketterlin-Geller & Johnstone, 2006; Lombardi & Murray, 2011; Shaw, 2011).

While the above literature provides valuable information on faculty preferences and suggestions for disability-related development activities, content, and format, there is a dearth of research on measured outcomes. Only a handful of studies have used appropriate design and methodology to allow for measurement of the impact of faculty development interventions.

Development outcomes on attitudes, knowledge, and practices. In one study of health faculty at a research university, a four hour workshop was provided which covered legal requirements, instructional strategies, learning technologies, and a role-playing sketch (Milligan, 2010). A pretest/posttest survey design was used to measure change in knowledge and attitudes (operationalized as intentions, awareness, and willingness) in regard to accommodations for students with disabilities. The effect of the training was most significant on the knowledge about legal requirements, accommodations, universal design of instruction, campus resources, technology, and attitudinal barriers. The training also had a significant effect on the willingness to change teaching practices and to accommodate students. In addition to perceptions of knowledge and attitudes, the researcher looked at faculty responses on the effectiveness of workshop activities. Role playing was seen as most effective in increasing knowledge about accommodations and in improving willingness to make changes to courses, while the question and answer portion was deemed most effective in raising awareness about processes and provision of accommodations. A large majority of faculty reported intention to incorporate universal design principles in their courses, although actual implementation was not measured.

The study had several limitations including a small sample size, a potential sample bias due to female participants only, an instrument error, and a number of missing responses with no information on whether and how these were dealt with in data analysis.

Another study used self-reports to examine possible relationships between prior training experience and disability-related training and faculty attitudes (Murray, Lombardi, Wren, & Keys, 2009). The participants were 217 faculty members at a Tier 3 research university in the United States. Training status was the grouping variable and ten attitude and perception factors served as criterion variables to examine a relationship between prior training and differences in attitudes toward students with learning disabilities (LD). The study applied a multivariate analysis of variance model with variable sets determined through exploratory factor analysis and with a satisfactory internal consistency. The training status distinguished among three groups of faculty: those who did not have any prior form of training, those who attended a course or a workshop, and those who had other forms of training, such as reading books, articles, and information provided on websites, or had other types of exposure to disability related information. The results of post-hoc tests showed that the two groups of faculty with prior training had significantly more general knowledge about LD, more willingness to provide accommodations, and higher perception of fairness and sensitivity than the group with no training. Furthermore, those who had past training had lower perceptions of resource constraints, were less likely to doubt students' LDs, and scored lower on insufficient knowledge of LD. Significant differences were also noted among the two training groups where those faculty who took a course or a workshop had higher scores on the general knowledge of LD than either the no training or the other training groups. The results of this study indicated that faculty who took any

form of training have overall more positive attitudes and perceptions toward students with learning disabilities. Additionally, those who took courses or workshops were more engaged with training resources and more knowledgeable than those faculty members who were exposed to other forms of training. When evaluating what forms of faculty development are most effective, the finding that workshops or courses result in more engagement by faculty and more knowledge and supports is particularly important. This result is in line with data from survey studies that report that faculty consider workshops as a preferred and most effective form of training (Murray et al., 2011).

Lombardi and Murray (2011) focused on psychometric validation of a survey instrument that measures disability-related faculty attitudes and practices – the Inclusive Teaching Strategies Inventory (ITSI), the instrument used in the present research project. Among the outcomes of the survey, administered to 289 faculty members and adjunct instructors, were the findings on the relationship between prior disability training and several dimensions of faculty knowledge and instructional practices. The researchers found that faculty who had received prior training had greater knowledge of legal responsibilities, made more attempts to minimize instructional barriers, had greater knowledge of available resources, had more willingness to invest time with students, and had greater academic expectations for students with disabilities. These findings were significantly different from faculty who had not attended prior training.

Development outcomes on universal design models. Faculty development in universal design of instruction has received much attention in recent years (Burgstahler & Cory, 2008; Higbee & Goff, 2008; Ouellett, 2004; Zeff, 2007). As discussed earlier, studies indicate that

faculty endorse the importance of universal design applications in teaching, but that they show low rates of actual implementation (Cook et al., 2009; Lombardi et al., 2011). There is evidence that disability-related training leads to positive attitudes toward incorporation of inclusive teaching practices such as those informed by the principles of universal design (Lombardi et al., 2011; Milligan, 2010).

Lombardi et al. (2011) examined the association between prior disability-related training and adoption of instructional practices informed by the principles of universal design among postsecondary faculty. The instrument used, the Inclusive Teaching Strategies Inventory (ITSI), was developed on the theoretical underpinnings of the universal design models and was previously validated by the same team of researchers (Lombardi & Murray, 2011). A hierarchical regression model was used to examine predictors of attitudes and actions toward inclusive instruction. Prior disability-related experiences, including previous work with students with disabilities and prior disability-related training, made small but significant contribution to the attitudes scores pertaining to accommodations, inclusive teaching strategies, and inclusive assessment. The factor of prior disability-training alone was a predictor of inclusive assessment and lecture strategies. In addition to attitude predictors, the results show that prior training is a unique predictor for multiple means of presentation, one of the three pillars of the Universal Design for Learning framework (Rose & Meyer, 2006). In other words, faculty who had taken disability-related training were more likely to report that they implement these strategies in their teaching.

In another study, five Ph.D. student instructors teaching introductory psychology received one hour of training on the principles of UDL, five times over the course of ten weeks as part of their mentoring meetings with an associate professor. A survey developed for the study was administered to students at the start and end of the semester, yielding1362 and 1223 responses, respectively (Schelly, Davies, & Spooner, 2011). There was a significant difference between first and second survey administration in student reports on the following changes in instructional practices: a) presented information in multiple formats; b) provided more course materials in electronic format; c) posted more assignments online; d) made key points in instructional videos more apparent; e) provided more prompt and constructive feedback on assignments; and f) supplemented lecture materials more with visual aids (Schelly et al., 2011). This study had several limitations. The survey instrument was not tested for reliability and validity aside from ascertaining a degree of face validity through a pilot administration and feedback from students; the content of the training was changed based on the student feedback from the first survey which brings to question the theoretical basis of the training and to what extent it was informed by UDL; and there was no control group to justify the attribution of observed changes to the effect of the training. Most importantly since the survey was administered to all students in the courses and while a number of students with disabilities in the sample was identified, no analysis was performed to compare the two groups. It is thus unclear how these findings inform our understanding of the value of UDL for students with disabilities. In spite of the limitations, a number of significant changes as observed by students suggests a possibility that information on the principles of universal design in instruction may have a positive effect on several aspects of course instruction and student evaluation of teaching quality.

Roberts et al. (2011) performed a review of literature published from 2000-2009, focusing on empirical research studies that investigated different models of universal design in instruction. Only eight studies met the criteria to qualify as an empirical study on universal design in higher education. A number of these studies are not relevant to the present discussion concerning faculty development outcomes. Five studies did not include teaching faculty as research participants (Embry, Parker, McGuire, & Scott, 2005; Harper & DeWaters, 2008; McGuire & Scott, 2006; McGuire-Schwartz & Arndt, 2007; Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007). Of the remaining three studies, two examined implementation of universal design in faculty practices, and one study focused on course design (Zhang, 2005; Izzo et al., 2008, Parker, Robinson, & Hannafin, 2007-2008). In Zhang's study (2005), faculty acknowledged the benefits of UDI and the need to change teaching methods to address diversity among learners. Izzo et al. (2008) first surveyed faculty and determined the need for professional development, which was then enacted in the form of a curriculum with teaching modules informed by the principles of universal design. The study found a significant increase in knowledge of UDL from 31% to 83%. In Parker et al.'s study (2007-2008) a course was redesigned through incorporation of UDI principles and was perceived as better than other courses based on student evaluations. Roberts et al. (2011) concluded that the literature on universal design in instruction "reflects the initial stages of a nascent literature base" (p. 13).

A more recent research review by Rao et al. (2014) evaluated 200 studies but identified only five sources that fit the criteria of an empirical study of universal design in higher education. Of the five research studies in postsecondary setting, three are most relevant to the present review of research on faculty development and universal design. The studies by McGuire-Schwartz and

Arndt (2007), Schelly et al. (2011), and Spooner, Baker, Harris, Ahlgrim-Delzell, and Browder (2007) evaluated the effects of development and training initiatives on instructional practices. All three have already been referenced earlier, separately (Schelly et al., 2011) and as part of the Roberts et al. (2011) review (McGuire-Schwartz, 2007; Spooner et al, 2007). Two out of the five studies in postsecondary setting made explicit connections between instructional methods used in the study and the principles of universal design models (Parker, Robinson, & Hannafin, 2008; Rao & Tanners, 2011). Overall, based on their review of selected research studies, Rao and colleagues concluded that the current research base on universal design models is problematic for several reasons. Most prominent in their critique and recommendations is the lack of a consistent operationalization of the principles of universal design. The claims about effectiveness of certain instructional methods are difficult to evaluate without an explicit connection between the practices employed and the principles of universal design.

The reviews by Roberts et al. (2011) and Rao et al. (2014) once again illustrate the problems associated with the current state of research on universal design in faculty development and instructional practices. The strikingly low number of empirical studies generated since universal design models emerged in education is particularly telling. In addition to the central issue of operationalizing and measuring the conceptually complex construct of universal design in education, there are a number of other shortcomings: methodologies employed are rudimentary, there is heavy reliance on case studies and self-reports, reports are limited to individual implementation of selective principles, surveys used have little evidence of instrument validity, conclusions are made on the basis of item-level analyses, samples are restricted or ungeneralizable, and there are unknown statistical properties or effect sizes. (e.g., Black et al.,

2014; Burgstahler & Cory, 2008; Higbee & Goff, 2008; Rodesiler & McGuire, 2015; Ward & Selvester, 2012).

Research Problem Statement

It is more than 15 years since the concept of universal design has emerged in areas related to postsecondary education and disability. Despite this relatively long period of time and its popularity, research on the implementation of various models of universal design has been limited, according to independent reviews discussed above (i.e., independent from the work done by the various authors associated with major universal design projects) (Edyburn, 2010; Orr & Hammig, 2009; Rao et al., 2014; Roberts et al., 2011). One way of interpreting this state of research on the outcomes of instructional practices informed by universal design models is suggested in a couple of studies, which show faculty embrace the principles of universal design and inclusive instruction, but also report low levels of actual use in practice (Cook et al., 2009; Lombardi et al., 2011). However, some findings are inconsistent and in fact contradictory in certain aspects. For example, Lombardi et al. (2011) found that in some cases faculty reported low agreement with principles but significantly higher implementation of the related practices. For this reason it is important to further investigate the relationship and suggested discrepancies between faculty attitudes and practices related to universal design and inclusive instruction.

As the review of literature shows, faculty see importance in professional development for the benefit of students with disabilities, and there are studies suggesting a positive relationship between disability-related training and disability-related attitudes, knowledge, and practices. Further, there is some evidence that faculty attitudes, knowledge, and practices in regards to

students with disabilities are positively related with several aspects of student academic functioning. These findings suggest that faculty development to improve attitudes, knowledge, and practices may lead to better academic outcomes for students with disabilities. However, the relationship between disability-related faculty development and faculty attitudes and practices is tentative at best, and needs to be confirmed with further research. The mostly correlational research base would benefit from more studies with experimental designs to demonstrate effectiveness of specific training activities.

We do not know if faculty development activities focused on disabilities are any more effective than general faculty development activities in promoting attitudes and practices in inclusive instruction. This point is about the noted observation found in disability or universal design (UD) literature concerning whether disability-focused teaching and learning recommendations, including various models of universal design, are fundamentally about sound pedagogical practices or simply good teaching (Edyburn, 2010; Hatfield, 2003; Shaw, 2011). Some authors consider this to be the greatest advantage of UD, the potential to help all students, not just those with disabilities (Shaw, 2011). Others warn that such assumptions will only lead to further marginalizing of students with disabilities by not recognizing their unique needs that go beyond just good teaching (Edyburn, 2010). What is implied in these views is that universal design models in education do not contribute unique value to our existing theories and models in teaching and learning. I have also argued that this overlap is one of the reasons UD models suffer from poor conceptual integrity and make it difficult to draw conclusions about the benefits for students with disabilities that are due to the impact of UD approaches, and not simply a result of quality instructional practices. We must establish if significant difference exists between

disability-focused and general faculty development interventions with respect to disability-related attitudes and practices.

From a methodological perspective, research in disability-related faculty development is in an early stage dominated by exploratory, descriptive, and practice-based case studies or informal surveys. Very few studies (e.g., Lombardi and colleagues, 2011, 2013) have employed rigorous research designs, validated assessment tools, and advanced methods of analysis. More studies using appropriate methodologies are needed in order to establish a relationship between disability-related faculty development, faculty attitudes, and especially practices. With respect to universal design models, their complexity and breadth present challenges to meaningful evaluation of their effectiveness and their relationship with faculty development, attitudes, and practices. It is critically important to use validated evaluation methods and instruments when investigating faculty implementation of instructional practices informed by universal design models. This will allow for the much needed comparison of findings among studies on the implementation of universal design principles, as well as what aspects of universal design are impacted by given faculty development activities.

In the context of Canadian higher education, studies on disability-related attitudes and practices in universal design and inclusive instruction, in relation to relevant faculty development, are virtually non-existent in the published literature. The need for Canadian studies is made even more pressing in jurisdictions such as Ontario where the AODA legislation requires training for educators in *accessible program or course delivery and instruction*, another way of formulating universal design and inclusive instruction. This is an unprecedented legislative requirement for

specific faculty development that calls for investment of significant time and resources in postsecondary institutions in Ontario. Examining disability-related faculty attitudes, practices, and development contributes to our understanding of areas on which to focus our efforts in the mandated educator training under the AODA. It is important for a number of reasons that AODA educator training be guided by relevant research on faculty development in inclusive instruction; from the need to reassure our postsecondary faculty that the training is evidence-based, to demonstrating value in the arena of public opinion where the utility of AODA has been questioned (Flaherty & Roussy, 2014).

Working within the disability services office at Carleton University and in collaboration with the university faculty development unit, I am primarily involved in faculty development in areas of disabilities and accessibility in teaching and learning. In order to inform the faculty development activities in these areas, with the view of the requirements under the AODA, the present study has been undertaken at Carleton University in Ottawa, Ontario.

Research questions. From the Research Problem Statement above, the following research questions are formulated and investigated in the present study:

1) What are the characteristics of faculty attitudes and practices with regards to inclusive instruction?
2) Are there discrepancies between faculty attitudes and practices in inclusive instruction?
3) Is there a relationship between disability-related training and faculty attitudes, practices, and knowledge in inclusive instruction?

4) Is there a relationship between disability-related training and general pedagogical training, and faculty attitudes and practices in inclusive instruction?
5) How effective is a one-time disability-related faculty development workshop in changing faculty attitudes and knowledge in inclusive instruction?

CHAPTER II

METHODS

The overall aim of this study is to examine the characteristics of university faculty *attitudes* and *practices* with regards to disability-related inclusive instruction, and their relationship with disability-related faculty development. To answer the five research questions outlined in the previous section, survey data from two samples recruited from Carleton University were used. The main sample consisted of faculty who have worked with students with disabilities in the past. They were the data source for answering research questions 1 through 4. To evaluate the effectiveness of the AODA educator training workshop (research question 5), an additional pre-post sample was recruited from among the workshop participants. The data for both samples were collected with the same instrument measuring faculty attitudes, actions, and knowledge in disability-related inclusive instruction and universal design.

Instrument

To measure faculty attitudes and practices in inclusive instruction and universal design, the Inclusive Teaching Strategies Inventory (ITSI) was used in this study (Lombardi, Murray, & Dallas, 2013). The ITSI survey instrument was originally developed to measure faculty attitudes and practices in areas representing the tenets of Universal Design in education as conceptualized in different theoretical models. The ITSI has been revised and validated across several studies (Lombardi & Sala-Bars, 2013; Lombardi & Murray, 2011; Lombardi et al., 2011). The ITSI survey is included in Appendix A.

The most recent cross-validation study using exploratory and confirmatory factor analysis has confirmed the total of eight constructs in the ITSI instrument (Lombardi & Sala-Bars, 2013): (1) Accommodations, (2) Accessible Course Materials, (3) Course Modifications, (4) Inclusive Lecture Strategies, (5) Inclusive Classroom, (6) Inclusive Assessment, (7) Disability Laws and Concepts, and (8) Campus Resources. Except for the constructs 'Disability Laws and Concepts' and 'Campus Resources,' all subscales consist of two response types, Attitudes and Actions. Each is determined by a unique response stem, while the same content for the construct is preserved. The Attitudes stem begins with 'I believe it is important to' while the Actions stem begins with 'I do'. For example:

> I believe it is important to… arrange extended time on exams for students who have documented disabilities.
>
> I do… arrange extended time on exams for students who have documented disabilities.

The construct 'Disability Laws and Concepts' consists of a single response stem, 'I am confident in', for example:

> I am confident in… my understanding of the legal definition of disability.

The 'Campus Resources' items also have a single response stem, 'I know', for example:

> I know… a Disability Services office exists on this campus.

Each ITSI subscale consists of a number of individual items (survey questions): Accommodations (8 items), Accessible Course Materials (4 items), Course Modifications (4 items), Inclusive Lecture Strategies (4 items), Inclusive Classroom (9 items), Inclusive Assessment (4 items), Disability Laws and Concepts (6 items), and Campus Resources (4 items). A subscale score for each respondent is derived by taking the mean of the subscale item scores.

In the present study, the number of response options for the Attitudes response type was reduced from 6 to 4. In the original instrument the response options were: Strongly Disagree, Disagree, Somewhat Disagree, Somewhat Agree, Agree, and Strongly Agree. For the present research study the response options were reduced by removing the 'Strongly Disagree' and 'Strongly Agree' options, leaving the following four response options: Disagree, Somewhat Disagree, Somewhat Agree, and Agree. This decision was made for the following reasons:

a) In the latest validation study for the ITSI comparing the United States and Spain, the US Attitudes responses were collapsed to a 4-point scale to match the Spanish data which were collected with a 4-point scale (Lombardi & Sala-Bars, 2013). The instrument retained previously demonstrated validity.
b) Given that the original forced choice response option set does not have a mid or neutral point, the item responses are fundamentally about whether or not the responder agrees or disagrees with the statements.
c) Since the Attitudes and Actions response options are presented for each statement, the total number of options in the original instrument for a participant to consider for each statement was 11 (6 for Attitudes and 5 for Actions, including 'No opportunity' option

for Actions response type). I was concerned about response fatigue due to the cognitive demands placed on the responder to sequentially distinguish a large number of options in the two sets of responses for Attitudes and Actions.

d) The issue of the optimal number of response options is not settled in the literature (Jones & Loe, 2013); and both sides of the argument have been taken into consideration with regards to the reasons outlined above. In this context, I decided that fewer options did not present a serious enough concern, while at the same time having fewer options addressed the reasons that inspired the change.

In the latest validation study, reliability of the subscales (the eight constructs) met what is generally considered acceptable criteria for internal consistency of .70 ('modest' as originally termed, Nunnally & Bernstein, 1994, p. 264–265), with Cronbach's alpha ranging from .71 to .89 for Attitudes and .70 to .91 for Actions scales. The exception was the Accessible Course Materials subscale with .66 and .65 alpha values for Attitudes and Actions (Lombardi & Sala-Bars, 2013).

Participants and Context of Study

The study was done at Carleton University during the 2013-2014 academic year. At the time of the study there were 22,957 full-time and 4,867 part-time students enrolled, including undergraduate, graduate, and special (no degree) students. There were slightly more male students at just over 52% compared to female students at 48% in the undergraduate and graduate population. The student population was predominantly native English speaking with only 2.8%

whose native language was French but with a considerable proportion of students whose first language is neither English nor French at 19.6%.

The data for students with disabilities came from the Disability Services Office (DSO), the Paul Menton Centre, a centralized university unit serving this population. Its organization and the services provided are similar to DSO's across the province of Ontario, which have fairly uniform functions and mandates driven by the provincially legislated human rights laws on accommodation and support for postsecondary students with disabilities. In the 2013-2014 academic year, there were a total of 1,922 students with a disability registered with the DSO. The largest proportion were students with learning disabilities (LD) at 29%, followed by psychiatric or mental health disabilities at 24%, attention deficit/hyperactivity disorder at 19%, and medical disabilities at 13%, while the other six categories such as mobility, sensory and autism spectrum comprised the remaining 15%. Finally 22% of all students registered at the DSO had multiple disabilities, i.e. other documented disability or disabilities in addition to the disability documented as the primary disability.

In the academic year 2013-2014 the university employed 841 full-time academic staff including professors, lecturers, and instructors, as well as 717 contract (or sessional) instructors. The faculty at the university are informed of the existence and purpose of the DSO through various means and the DSO has a visible presence on campus. The teaching faculty and instructors are involved to a degree in the process of accommodating students with disabilities. Formal academic accommodations, such as extra time on exams or supplemental volunteer notes, are communicated to the course instructors via the Letter of Accommodation (LoA). The LoA is

emailed each term to the course instructors, after the student requests accommodations for the course. The course instructor is expected to submit their in-class test information to the examination centre dedicated to exams with accommodation. The instructor is also asked to help recruit a volunteer note taker in the class, if requested as accommodation. And the instructor is expected to be willing to meet with each student with a LoA to discuss their accommodations, as needed. Typically, most instructors accept recommended accommodations as outlined on the LoA. Instructors are able to question recommended accommodations, discuss appropriate alternatives with the student and the student's DSO coordinator, or engage in formal refusal and revaluation of accommodations through the Accommodation Appeal Committee.

Historically, the DSO has been actively engaged in faculty outreach and professional development, most often in partnership with the teaching and learning unit which provides educational development to the teaching faculty and sessional instructors at the university. The DSO delivers on average 5-7 workshops per academic year to various groups of educators at the university and takes part in the new faculty orientation and other events at the university which cater to educators. The DSO also directs the course instructors to its online resources for educators at the university with a link included in all email communication which accompanies the formally approved LoA. At the time of the study, the DSO and the teaching and learning unit were offering a 2.5-hour workshop on what was termed *Accessible Learning*. The workshop was developed initially as part of the efforts to introduce the ideas of universal design in education, and was later adapted to formally meet the educator training requirements legislated by the AODA, as discussed in the preceding sections.

The Accessible Learning Workshop. The Accessible Learning workshop is 2.5-3 hours in length. It is designed to expose educators to issues related to students with disabilities in postsecondary learning environments. The content covers the following:

a) The reasons to focus on accessibility and universal design in learning environments, such as the legal mandates and policies, and consideration of issues of equity and social responsibility.
b) Overview of disabilities, with statistics ranging from national surveys in North America to the local institutional context at Carleton University.
c) The barriers that emerge at the intersection of learner diversity and learning environments, with a primary focus on barriers due to disability in relation to typical course and program requirements in postsecondary settings. Barriers experienced by other underrepresented student groups are also reviewed.
d) Examination of personal epistemological beliefs and perceptions of teaching and learning, as a preliminary step in consideration of pedagogical change aligned with inclusive instructional practices and accessible learning.
e) Review of the models of universal design in education, specifically Universal Design for Learning (UDL) as developed in the U.S. by the CAST organization, and Universal Instructional Design (UID) as conceptualized by a project at the University of Guelph in Ontario, Canada.

The content is delivered with a variety of methods, including:

a) Presentation of information by the workshop facilitator with the use of slides with integrated multimedia and participant real-time polling.

b) Videos featuring Carleton University students, staff, and faculty addressing specific core content from the workshop as well as providing examples and illustrative personal experiences.
c) A simulation of a reading disability where participants experience first-hand the characteristic barriers related to the mechanics of reading and comprehension difficulties.
d) Use of clickers to deliver quizzes with real-time results that solicit feedback and facilitate reflection and discussion.
e) Points of debate on contentious issues related to current practices in disability services and ideas related to universal design.
f) Hands-on review and discussion of personally meaningful aspects of teaching or course design in relation to guidelines from the universal design models of instruction.

Procedures

Following the Research Ethics Board (REB) approvals at McGill University and Carleton University, invitations to participate in the research study were sent by email to targeted participants. As mentioned earlier, two samples used in the study were recruited separately. The *'LoA'* sample – the main sample used for research questions 1 through 4 – consisted of faculty members and instructors who had received a Letter of Accommodation (LoA) for a student or students in the last three years prior to the study, according to the records from the DSO. The *'Workshop'* sample, used for research question 5, consisted of the faculty members and instructors who attended the AODA Accessible Learning workshop. One faculty member was present in both samples, however this was not of concern because the two samples were used for separate research questions and separate analyses. The two samples are described in more detail

in the Sample and Response Rates section below. Participants in each sample were emailed an invitation to take the ITSI in the form of an online survey (Lombardi et al., 2011).

An email invitation asked participants to reply to the email and confirm willingness to participate. Those who confirmed were entered into the online survey system and assigned a token ID. This ID was used to track pre-post survey submissions by the same participant. Asking participants to first confirm participation was necessary in order to enter them into a draw for gift cards. While the names of the participants were recorded in the system for the gift card draw purposes, their submissions were not connected to their names and were tracked instead with the token ID. Still, the fact the names were recorded for the draw prevented a fully anonymous participation in the survey.

The online survey was hosted free of charge by an online survey website located in the United States (Qualtrics.com). In order to proceed with the survey, a participant had to first agree to the Consent Form presented when the survey link was opened. Participants were able to partially fill out the survey and return to complete it at a later time. Once data collection was completed, survey data were downloaded for analysis, without the participant names.

For each survey taken, a participant's name was added into a draw to win one of five $50 gift cards for Chapters/Indigo bookstores. Once data collection was completed, a random number generating software was used to select five gift card recipients. The specifics of the draw were approved along with all other aspects of the study by the two REBs.

Sample and Response Rates

The LoA sample. The invitation to the ITSI survey was sent by email to course instructors who taught a course at the university and received one or more LoAs over a three-year period, from September 2010 to April 2013. The initial email invitation was sent in September 2013. The decision to invite only the course instructors who received LoAs was made to ensure the survey, which is focused on issues of disability, accommodation, and universal design, was seen as relevant. While this strategy made survey questions relevant, it also may have affected the participation rate. As mentioned previously, on average each year about 45% of educators at the university are sessional instructors, hired on contract to teach individual courses. While there are sessional instructors who are rehired on a regular basis, many are not or are unable to return to teach, and may not maintain contact with the university. In addition, the email contacts for sessional instructors are not as reliable since sessional lecturers do not necessarily use the official university email addresses, or no longer use the university email assigned to them when they taught a course two or three years previously. Considering the time span of three years, it is also possible that some regular faculty members were no longer at the university or were unreachable for different reasons. While the emails that were sent back as undeliverable ('bounced back') were not counted in the response rate calculation, it is unknown how many emails were delivered to email addresses which may no longer be used by former course instructors and faculty members.

The invitation to participate in the study was emailed only once, with no follow-up reminder email. This was done primarily in keeping with an administrative position held by the university that emails to faculty are already excessive and should be minimized as much as possible. As

later confirmed, the absence of a follow-up invitation, a common practice in studies with a similar recruitment strategy, contributed to the low initial response rate, in addition to the possibly outdated instructor addresses. After consolidation, the total number of unique invitation email addresses was 1162. Only 81 participants were recruited following the initial invitation at the end of September 2013, a 7% response rate[2]. That response rate was considerably below the general rates in similar web-based surveys (Manfreda, Bosnjak, Berzelak, Haas, & Vehovar, 2008; Shih & Fan, 2009), leading to question the extent to which the 81 person sample was representative of the population of faculty who have received accommodation requests in the three years prior to the study. For this reason, the 'nonresponders' from the initially invited LoA group were contacted in September 2014 and asked again to fill out the same survey, to determine if the responders and nonresponders differed on the survey measures. A total of 241 responses were received from nonresponders, demonstrating the original invitation was not as effective in generating a good response rate. Informally, over 70 faculty members and instructors from the nonresponder sample sent unsolicited comments by email in addition to the anonymous survey submission, expressing support and many indicating they did not receive or do not recall receiving the initial invitation. Following statistical comparison of the Responders and Nonresponders groups (see Chapter II), it was determined the two groups were not different and were combined, and following the missing data treatment on both samples the resulting LoA sample had 314 participants, representing a 27% response rate.

[2] The 81 participants were administered the ITSI survey twice as per the original repeat measures design which was later abandoned.

The Workshop sample. ITSI survey invitations were sent to faculty members and instructors who attended one of seven Accessible Learning workshops presented between March and November 2013. Following the originally proposed research design, one or two email invitations were sent prior to the workshop asking those who were signed up to volunteer to participate in a series of pre-post surveys. Those who filled out the pre-Workshop survey were invited to fill out one or two post-Workshop surveys, with one immediately following the workshop and the other, if applicable, 3-4 months later. The combined number of those who were signed up to attend the seven workshops and who have received the initial pre-Workshop survey invitations was 71. Data were collected between March 2013 and January 2014. A total of 21 participants responded to the invitations by participating in the pre and post Workshop surveys. The resulting response rate for the Workshop group was therefore 29%. It should be noted again that the LoA sample with 314 cases is the primary sample used for data analysis in the first four research questions. The Workshop sample data are used in the pre-post analysis for the Research Question 5 only, as discussed below in the section *Data analysis approach*.

Response rates. The response rates for the final Workshop and the LoA samples were 29% and 27%, respectively. These response rates were considered acceptable as they are consistent with survey response rates in studies that administered the ITSI and more generally studies of faculty attitudes and practices related to students with disabilities or issues of universal design in instruction (e.g. Bourke et al., 2000; Izzo et al., 2008; Lombardi & Murray, 2011; Lombardi et al., 2011; Murray, Flannery, et al., 2008; Vogel et al., 2006). The response rates in the present study are slightly below the average response rates for web-based surveys in general, found to be at 33% in two recent meta-analyses (Manfreda et al., 2008; Shih & Fan, 2009).

In recent years, response rate as an indicator of the risk of nonresponse bias has been questioned (Wagner, 2012). One of the alternative approaches to evaluating nonresponse bias is to consider later waves of surveying as being representative of nonresponders (Lahaut et al., 2003; Miller & Smith, 1983). In the present study, the second wave of surveying was done a year following the first wave, after contacting those who did not respond in the first wave. The contact email identified them as nonresponders and invited them to respond as such. As discussed in Chapter II, the nonresponder data for the LoA sample was not significantly different on the measures of interest from the first wave data, thereby demonstrating absence of nonresponse bias on the measures of interest. It is acknowledged that only two waves of surveying were done, and that there were still nonresponders in the second wave. It should also be noted that such nonresponder recruitment and analysis were not done for the Workshop group. This was not practically possible because the pre-test survey had to be done prior to the Workshop. It was not possible to determine nonresponders and have them fill out the survey prior to the Workshop since the Workshop participants were invited to reply to the pre-test survey up to the very start of the Workshop. Once the Workshop had passed, the data from nonresponders as a pre-test condition was no longer collectable since they had attended the Workshop.

To further evaluate representativeness of the sample, the participants in the Workshop and LoA samples were subjectively compared on available demographics with the general population of faculty at the University. TablesTable 1 andTable 2 and FiguresFigure *1* to Figure *3* present the comparative data, and suggest that the Workshop sample is very similar in representation of the Faculties when compared to the University population, except for the absence of Business

faculty. The LoA sample has a higher proportion from Arts and Social Sciences and a lower proportion from Engineering, compared to the University population.

Table 1

Proportion of Teaching Faculty at the University and the Two Samples

	University		Workshop Sample		LoA Sample	
Faculty	N	%	N	%	N	%
Arts and Social Sciences	306	36.0	8	38.1	150	47.2
Engineering and Design	146	17.2	3	14.3	25	7.9
Public Affairs	183	21.5	4	19.0	63	19.8
Science	158	18.6	6	28.6	47	14.8
Business	57	6.7	0	0	32	10.1
Total	850	100.0	21	100.0	317[3]	100.0

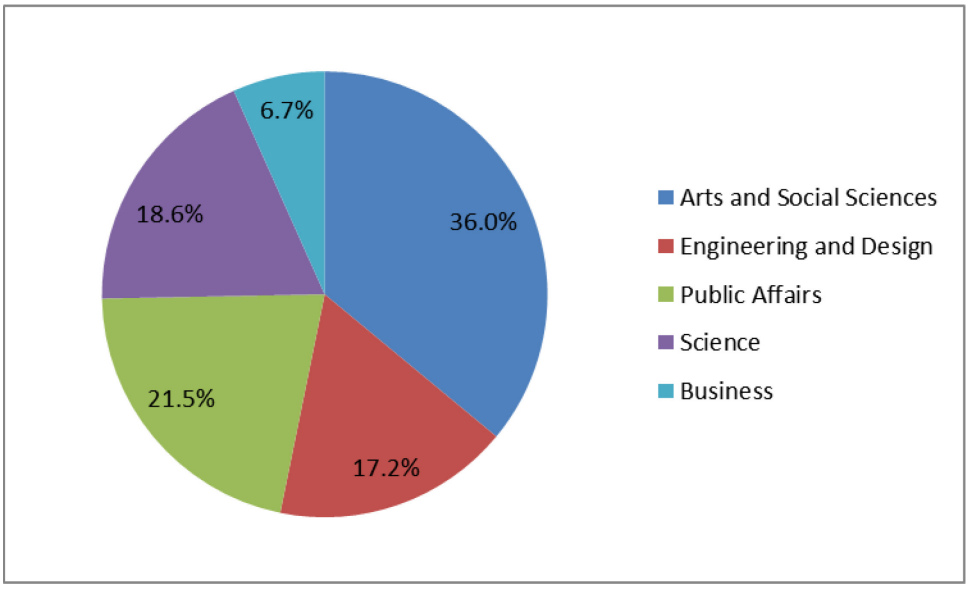

Figure 1. Proportion of teaching faculty at the University.

[3] While the final number of participants in the LoA sample was 314, demographic data was available for an additional 3 participants.

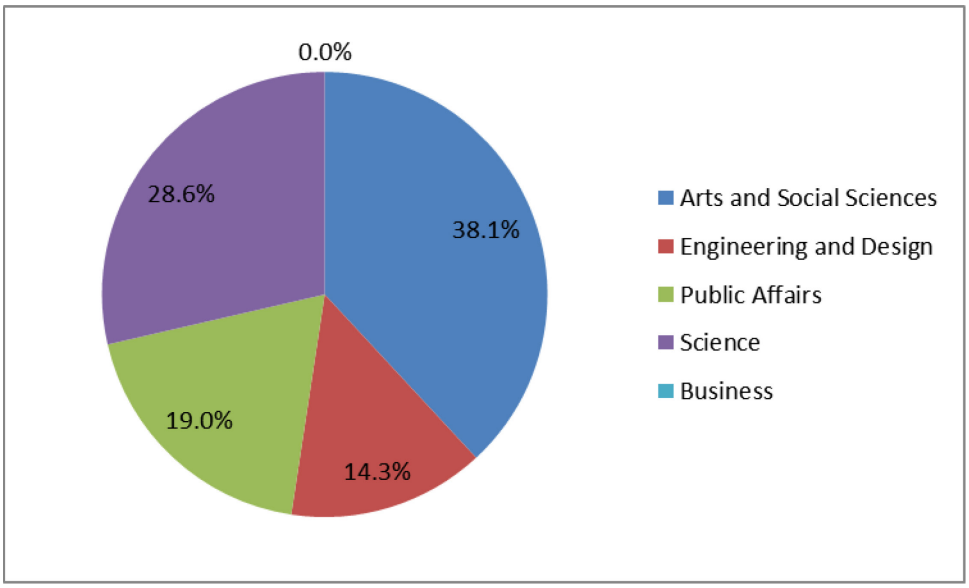

Figure 2. Proportion of teaching faculty in the Workshop sample.

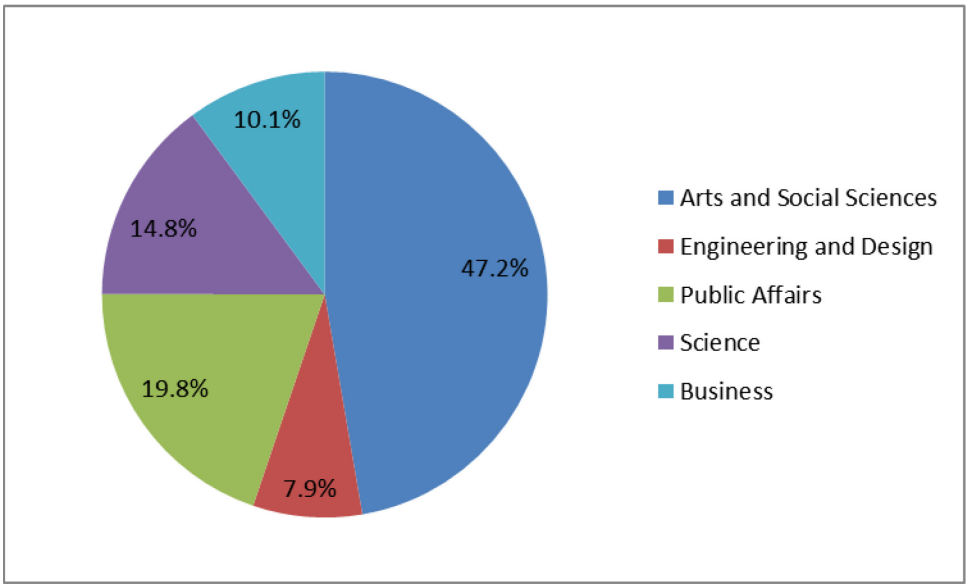

Figure 3. Proportion of teaching faculty in the LoA sample.

With respect to faculty rank, Table 2 shows data comparing the University population and the two samples. The two samples are very similar to the University population, specifically when compared across two overall categories of Professor and Instructor. The University population

has an overall 49.8% of academic staff at the rank of a professor and 50.2% at the rank of an instructor. The Workshop group has an overall 52.4% of participants at the rank of a professor and 47.7% at the rank of an instructor. The LoA group has an overall 52.5% of participants at the rank of a professor and 47.4% at the rank of an instructor.

As far as gender representation, the combined sample of the Workshop and LoA groups has 46% of women, compared to 35.5% of women faculty in the University population.

Table 2

Faculty Rank Proportions at the University Compared to the Two Sample Groups

	University		Workshop Sample		LoA Sample	
Rank	N	%	N	%	N	%
Full Professor	226	14.1	1	4.8	26	8.2
Associate Professor	375	23.3	4	19.0	86	27.0
Assistant Professor	158	9.8	6	28.6	34	10.7
Adjunct Professor	N/A	N/A	0	0	8	2.5
Emeritus/Post-retire	41	2.6	0	0	13	4.1
Instructor	806	50.2	10	47.7	151	47.4
Total	1606	100	21	100	317	100

Considering the response rates in other studies using ITSI or studies surveying faculty attitudes, the general web-based survey response rates, and the comparative data at the University on faculty affiliation, rank, and gender, the sample in the present study can be considered sufficiently representative of the University population from which it was sampled to proceed with data analysis.

Experience and training data. In addition to the faculty affiliation, rank, and gender, as reported above, the participants were asked to report their age (as range), years teaching (as range), and type of courses taught. The mode for age in both the Workshop and the LoA samples was the '35-44' age range. The mode for years teaching in both the Workshop and the LoA samples was the 'Over 10 years' range. In the Workshop group approximately 70% of participants reported teaching major-specific courses, while 10% reported teaching general education courses, electives, and lab/tutorials each. The LoA group also reported mainly teaching major-specific courses at 58%, while about 15% taught general education and elective courses, 9% graduate level courses, and only 1% lab/tutorials.

The participating faculty were also asked about the years of experience teaching postsecondary students with disabilities. In the Workshop sample, 5% reported not having taught students with disabilities in the last five years. The highest proportion (38%) of faculty in the Workshop sample taught 11-20 students, with 19% reporting 1-5 students, 14% reporting Over 20, and 10% reporting 6-10 students with disabilities in the last five years. In the LoA sample, a small proportion (3%) reported not having taught students with disabilities in the previous five years, even though they were selected because they had received a LoA during the 3 year period prior to the study. The most frequent response was at the highest number of students taught, Over 20, with 35% faculty reporting. About an equal proportion of faculty taught fewer than 5 (18%), 6-10 (19%) and 11-20 (15%) students with disabilities in the previous 5 years.

In addition to numbers of students with disabilities taught, personal experience of disability was also reported to help determine degree of familiarity with disabilities. Multiple selections were

possible on this item. In the Workshop sample, 24% identified as having a disability, 52% have a family member, friend, or a personal contact with a disability, 71% have worked with a student with a disability, while 14% report having no personal experience of disability. In the LoA sample, 9% self-identified with a disability, 45% have a family member or friend with a disability, 73% have worked with students with disabilities, and 17% have no experience of disability.

Lastly, participant data were collected on past training related to disability or working with students with disabilities, such as attending workshops, taking courses, reading books, or visiting websites. Multiple selections were possible on this item. In the Workshop sample 33% had received training in the past, most attended workshops or visited websites (both at 57.1%), and/or read books/articles (43%), the majority of those (71%) reporting 1-3 hours of training. In the LoA sample, 53% indicated they had received training, again majority (46%) reporting 1-3 hours of training, 21% between 4-6, and 19% over 10 hours of training. Workshops were the most common type of training (64%). Thirty seven percent read books or articles, 39% visited websites, and 12% took one or two courses.

Data Analysis Approach

Most primary data analyses were performed with SPSS software, v.22 and v.23 (IBM Corporation, 2013a, 2015). Additional and comparative analyses were done with R statistical and programming software, v.3.2.3 (R Core Team, 2015). Data analysis methods for each research question are summarized in this section, while the detailed analyses and results are reported in the chapter that follows.

Research question 1. What are the characteristics of faculty attitudes and practices with regards to inclusive instruction?

Descriptive statistics and multivariate analyses of variance (MANOVA) were used to analyze the characteristics of reported attitudes ('Attitudes' in the ITSI instrument) and practices ('Actions' in the ITSI instrument) toward disabilities and inclusive instruction by Carleton University faculty. The mean was used to present average levels of agreement with statements representing faculty Attitudes and Actions in each of the constructs of the ITSI instrument, pedagogical areas in inclusive instruction or universal design (e.g. Inclusive Lecture Strategies). This can inform the focus of faculty development activities in inclusive instruction to address areas where faculty report disagreement with certain aspects of inclusive instruction or low implementation in practice. Attitudes and Actions were further analyzed as dependent variables in MANOVA models with group comparisons based on gender, faculty affiliation, and rank, as independent variables. Such description of group characteristics may allow for more targeted faculty development activities in accessibility awareness and inclusive instruction under the AODA requirement for educator training, in different segments of the university population.

Research question 2. Are there discrepancies between attitudes and practices in inclusive instruction?

Contingency tables were calculated to determine whether there were discrepancies between Attitudes and Actions on each of the six ITSI constructs (subscales). Cell differences between

the response categories of Attitudes and Actions were tested with the chi-square test of independence and use of adjusted standardized residuals to determine if any observable differences were significant, while the direction of the difference was visually determined. This was intended to specifically confirm some of the prior research findings of the reported discrepancies in attitudes toward certain instructional practices and the actual implementation of those practices. Such discrepancies have implications on whether faculty development activities should place emphasis on faculty attitudes or on practical implementation, with differentiation among various universal design instructional practices as represented by the ITSI subscales.

Research question 3: Is there a relationship between disability-related training and faculty attitudes, practices, and knowledge in inclusive instruction?

The LoA sample data were analyzed with a series of multivariate ANOVA models (MANOVA). Of interest were both a multivariate combination of subscale scores at the global level of Attitudes and Actions dimensions, as well as relationships between disability-training variables and individual ITSI subscales. In other words, I wished to determine if faculty development activities focused on students with disabilities were related to attitudes and practices in inclusive instruction, conceptualized in the ITSI as Attitudes and Actions global dimensions. But also, it was reasonable to expect that disability-related training may have a stronger relationship with certain aspects of ITSI Attitudes and Actions, the individual subscales, such as for example willingness to accommodate. This assumption was based on the fact that universal design and inclusive instruction as a focus in faculty development is fairly new. For this reason, in addition to Attitudes and Actions subscales, two Knowledge ITSI subscales were included in the

analyses, because traditionally disability-related training is focused on increasing knowledge about disabilities and accommodations. To examine specific areas where different levels of training were a factor, univariate ANOVAs and post-hoc analyses, with adjusted p-values, on specific subscales within Attitudes and Actions, as well as Knowledge subscales were conducted.

Research question 4. Is there a relationship between disability-related training and general pedagogical training, and faculty attitudes and practices in inclusive instruction?

Multivariate ANOVA analyses were used to determine if there is a relationship between general pedagogical training and ITSI subscales on Attitudes and Actions in inclusive instructional practices. This analysis was intended to address the oft-cited views that recommendations for inclusive instructional practices or universal design instructional models are simply good teaching practices. Findings from the analysis on general pedagogical training were then examined in relation to the findings on disability-related training within the current research project. Where the results of separate analyses showed significant effects of both general and disability-related training on specific ITSI subscales, hierarchical regression was performed to investigate the degree of unique contribution for each. Hierarchical regression allowed to determine if disability-related training is a predictor of faculty Attitudes and Actions in inclusive instruction, over and above the influence of general pedagogical training. Results of the above hierarchical regression analyses can have a number of implications for faculty development in inclusive instruction and the emphasis placed on general versus disability-related training, e.g., the focus of the content and channels for delivery, what type of professionals and units are

involved, as well as how funding is allocated. Ultimately, it may inform the ways to address the educator training requirement in inclusive instructional practices under the AODA legislation.

Research question 5. How effective is a one-time disability-related faculty development workshop in changing faculty attitudes and knowledge in inclusive instruction?

Paired-sample t-tests were performed on each ITSI subscale to assess short-term effects of the AODA Accessible Learning workshop. Correlational research examining the relationship between past disability-related training and faculty attitudes and practices has been done before, as reported in the literature review. There is of course value in replicating and evaluating existing research findings with a large sample of Carleton University faculty to examine the relationship between training and ITSI subscales, as outlined above for research questions 3 and 4. However, to further evaluate this relationship, the present study included an experimental condition in which a smaller sample, the Workshop sample, provided pre-workshop and post-workshop data on the ITSI. A paired sample t-test was performed on the Workshop sample data to determine if there were significant mean differences on ITSI subscales before and after the AODA Accessible Learning workshop. In this analysis the relationship between disability-related training and ITSI Attitudes and Actions was tested in a repeated measures design with the participants serving as their own controls in order to evaluate short-term effects of the AODA Accessible Learning workshop. This additional level of analysis was used to further corroborate the findings from correlational research, both from the present research project and past studies.

CHAPTER III

DATA ANALYSIS AND RESULTS

Recoding of Responses

Actions scales of the ITSI instrument measure the degree of implementation or use of specific practices, and include the response option 'Not Applicable' for those who never had an opportunity to use specific practices (e.g., a past practice related to students with disabilities is not applicable for faculty who never worked with students with disabilities). Since the values of the Actions items range from 1 (Never) to 4 (Always), and 5 (Not Applicable), the value for Not Applicable had to be recoded in order not to bias calculations of the Actions subscales. The Not Applicable responses were recoded from 5 to 0 (zero). It could be argued that the use of zero for Not Applicable would result in a negative bias, however considering the nature of the scale measuring the *prevalence* of practices, this is considered to be appropriate. A response of Not Applicable coded as zero then represents the lowest increment in the range measuring the prevalence of a certain practice. The response value of 0 is considered different, and lower, than response value of 1 (Never) because it indicates no opportunity for the practice while the response of 1 indicates opportunity may have existed but was not utilized (e.g. a course instructor decided not to implement a certain practice). This interpretation of the response range for the Actions items and recoding of Not Applicable as zero was used for the construction and validation of the ITSI and the subsequent studies with ITSI by its author (A. Lombardi, personal communication, December 11, 2014).

Responders-Nonresponders Analysis

As reported in the Methods chapter, the overall LoA sample consists of the faculty members and instructors who received Letters of Accommodation (LoA) over a 3-year period. Since the initial sampling of the LoA group had a 7% response rate with 81 responses collected, there was a concern over nonresponse bias. The approach to address this was to compare responders with nonresponders to determine if there was a difference on the measurement factors, the Attitudes and Actions ITSI subscales. An email invitation was sent to those who did not respond to the initial invitation to participate and the resulting data were labeled as LoA Nonresponders with 241 cases.

The goal was to determine whether the two groups, LoA Responders and Nonresponders, were significantly different on the outcome measures, and consequently to make a decision whether the data from the two groups can be combined for analysis. Only the first survey data from the Responders group was used in this analysis, which included 78 cases, while the Nonresponders data to combine had 240 cases after one case was removed from a participant who was already included in the Responder data. The LoA Responders-Nonresponders data were first examined visually with box plots to check the patterns of spread between the two groups. This was particularly important considering the two groups had very different sample sizes. While the group size alone is not of concern in multivariate analyses as most modern software packages including SPSS adjust for unequal group sizes in procedures such as MANOVA, heteroscedasticity coupled with unequal sample sizes may be problematic (Hair, Black, Babin, & Anderson, 2010; Tabachnick & Fidell, 2007). Visual inspection of box plots suggested equal spread between Responders and Nonresponders on the six Attitudes and six Actions subscales.

Box plots for two variables, Attitudes: Inclusive Lecture Strategies (ATT_ILS) and Actions: Course Modifications (ACT_CM) were inconclusive. To formally test for homoscedasticity, Levene's test for equality of variances was performed. For each paired comparison on all the variables the test failed to reject the null hypothesis that the variances were equal (Table 3). It will be noted that for variable ATT_ILS the test based on the mean reached significance at .05 however since the data were skewed, the median test is more appropriate and was not significant.

Table 3

Levene's Test p-values for Attitudes and Actions Subscales Comparing Responders and Nonresponders

	Attitudes (ATT)		Actions (ACT)	
ITSI subscales	*p* for Mean	*p* for Median	*p* for Mean	*p* for Median
Accommodations (ACC)	.891	. 862	. 229	. 317
Accessible Course Materials (ACM)	. 602	. 694	. 682	. 702
Course Modifications (CM)	. 668	. 694	. 537	. 764
Inclusive Lecture Strategies (ILS)	. 045	. 105	. 540	. 565
Inclusive Classroom (IC)	. 697	. 828	. 071	. 089
Inclusive Assessment (IA)	. 828	. 806	. 907	. 835

The Responders-Nonresponders analysis proceeded to test the hypothesis that the responders were not different from nonresponders on Attitudes and Actions subscales, in other words that both could be assumed to be sampled from the same population. This hypothesis was tested with a single factor multivariate analysis of variance (MANOVA) across the Attitudes and Actions subscales of the ITSI. No significant differences in the multivariate combination of the Attitudes subscales for the Responders-Nonresponders factor were found, with Wilks' $\Lambda = 0.983$, F(6, 308)

= 0.865, $p = 0.521$. Similarly, no significant differences in the multivariate combination of the Actions subscales for the Responders-Nonresponders factor were found, with Wilks' $\Lambda = 0.977$, $F(6, 308) = 1.198$, $p = 0.307$. In addition, Cohen's *d* was used to evaluate degree of distribution overlap between the two groups (Table 4). The two groups had minimal non-overlap, with Cohen's *d* of .1 or less demonstrating less than 7.7% of non-overlap, on all but three scales. Subscales ATT_ILS, ATT_IA, and ACT_IA had the effect size of .2, which is still considered to be a small effect size and constitutes less than 14.7% non-overlap of the distribution of scores between the two groups (Cohen, 1988, pp. 21-23). Based on the nonsignificant MANOVA as well as the effect sizes and degree of non-overlap, it was concluded the two groups were sampled from the same population. Therefore, the data for the LoA Responder and Nonresponder groups were combined, resulting in the total of 318 cases in the final LoA combined sample including the cases with missing values.

Table 4

Cohen's d for Attitudes and Actions Subscales Comparing Responders and Nonresponders

	Cohen's *d* values	
ITSI subscales	Attitudes (ATT)	Actions (ACT)
Accommodations (ACC)	. 039	-. 108
Accessible Course Materials (ACM)	. 158	. 121
Course Modifications (CM)	. 122	-. 071
Inclusive Lecture Strategies (ILS)	. 247	-. 064
Inclusive Classroom (IC)	. 179	. 056
Inclusive Assessment (IA)	. 212	. 242

Pre-Test/Post-Test Data Consolidation (Workshop Sample)

In the original proposal for the study, the research design involved two cohorts for the Workshop group. The first cohort was to receive one pre-test (pre-workshop) survey and two post-test (post-workshop) surveys, while the second cohort was to receive two pre-test surveys and one post-test survey. Known as the switching replications design, the first cohort takes the workshop (treatment condition) while the second cohort serves as a control, then the second cohort takes the workshop while the first serves as a control.

Although the switching replications design has benefits, due to low workshop attendance implementing this two-cohort design was not feasible as it would have resulted in very small cell sizes for each cohort pre or post-test. While data for the Workshop group were still collected according to the original design, it was observed that there were considerably fewer responses for the second pre and post-tests. The decision was made to use only the first wave of pre-test and the first wave of post-test responses. Table 5 illustrates with an example of responses to question 30_1_1 with T1 and T2 as the two pre-test responses, and T3 and T4 as the two post-test responses.

Prior to data consolidation, the Wilcoxon Signed Rank Test was used to determine if the two responses in pre-test (T1 and T2) and the two responses in post-test (T3 and T4) were significantly different. It was determined that there were no significant differences within each pre-test and post-test response pair. The Wilcoxon Z statistic for T1 and T2 in the example from Table 5 was nonsignificant with the *p* value of 1.0, thereby accepting the null hypothesis that T1

and T2 are equal. In this particular example for question 30_1_1, it was not necessary to run Wilcoxon for T3 and T4 since all the responses were numerically equal between T3 and T4.

Table 5

Participant Responses for Two Pre-Tests and Two Post-Tests for Question Q30_1_1

Participant	Q30_1_1 (T1)	Q30_1_1 (T2)	Q30_1_1 (T3)	Q30_1_1 (T4)
1	4		x	x
2	4		4	4
3	2		x	x
4	4		4	4
5	4		4	4
6	4		4	4
7	3	x	4	
8	4	3	3	
9	3	3	x	
10	3	3	4	
11	3	3	4	
12	3	3	4	
13	4	4	3	
14	4	4	4	
15	4	4	4	
16	4	4	4	
17	3	4	4	
18	4	4	4	
19	4	4	4	
20	4	4	4	
21	4	4	4	

Note. Blank cell indicates response was not collected as part of the research design. 'x' indicates a missing value due to participant nonresponse.

After the Wilcoxon test was performed for all items in the survey, it was concluded that the responses of participants who took two surveys prior to the workshop did not differ significantly between the two surveys, and similarly, the responses of participants who took two surveys after the workshop did not differ significantly between the two surveys. Therefore, only T1 (first pre-test) and T3 (first post-test) responses were used for the Workshop sample.

Missing Data

LoA sample. In the data from the main sample, the LoA sample, which was the data source for answering the first four research questions, there were overall 0.78% values missing from four cases (Figure 4). The term 'values' in the missing data analysis here refers to the responses to individual survey items (questions) by each participant (case). It is important to note that missing data analysis and subsequent treatment were performed at the item level, rather than ITSI subscale level. The missing data in the LoA sample were treated with listwise deletion – the four cases with missing values were removed. This was justifiable because the percentage of missing values was significantly below the generally accepted cut-off of 5% and is considered to be statistically inconsequential (Graham, 2009). Following listwise deletion the total number of cases in the LoA sample was 314.

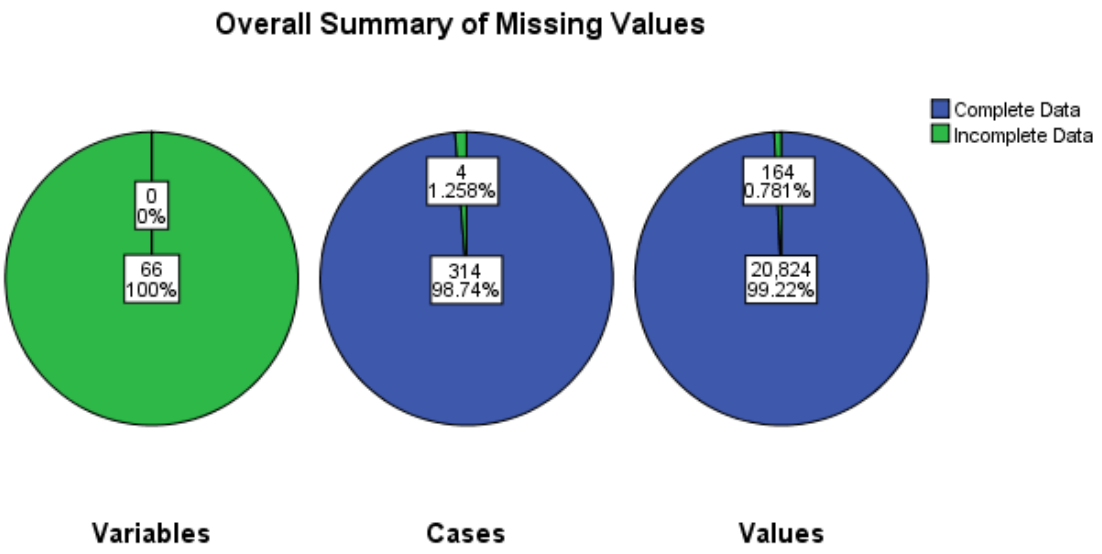

Figure 4. Summary of missing data in the LoA sample.

Workshop sample. As discussed in the Methods chapter, Research Question 5 involved pre-post paired-sample analyses. The missing value analysis in the Workshop sample was performed on data that included both the pre-test and the post-test values since any subsequent missing data treatment model would have to include both the pre-test and the post-test data. For example, when using listwise deletion, a case with missing data is deleted including the pre-test and post-test values for that case, because the data must stay balanced for pre-test/post-test comparisons. Similarly, a multiple imputation model includes both pre-test and post-test variables because the subsequent data analysis will involve comparison of pre-test and post-test data.

In the Workshop sample across both the pre-test and the post-test surveys combined, there were 7.14% of values missing contained in 3 cases, with 50% of variables having missing data (Figure 5). When the pattern of missingness was examined visually, it was evident that the 50% split

between variables with missing and non-missing data was due to the post-test with no missing data on the pre-test.

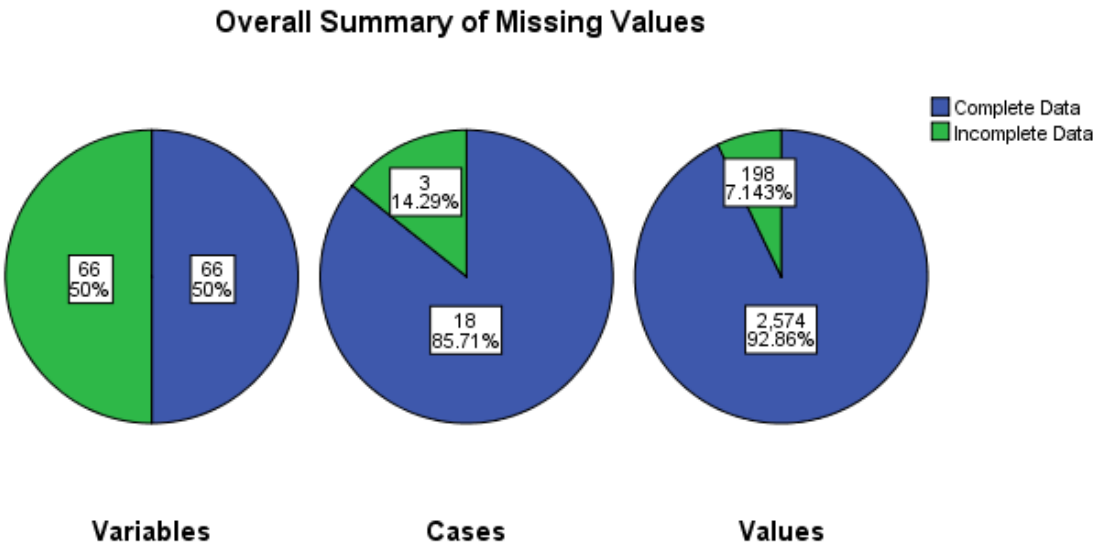

Figure 5. Summary of missing data in the Workshop sample.

As seen above, the analysis of the missing data reveals that in the Workshop sample data were primarily missing due to non-response on the entire survey (i.e., due to dropout on post-test). Viewed another way, the dominant missing pattern was *unit non-response* (entire record missing) as opposed to *item non-response* (individual question response missing), a missing data terminology used for Likert-type surveys such as the one in the present study (Andridge & Little, 2010; Schafer & Graham, 2002). Furthermore, data were missing on the post-test, known as *wave nonresponse* (Schafer & Graham, 2002). The proportion of missing data on the post-test exceeded the 5% cut-off limit, as compared to the pre-test that had no data missing in the Workshop sample. In other words, considering that missing data were characterized by unit and

wave nonresponse, it was concluded that data in the Workshop sample were missing due to survey drop-out.

The decision was made to impute missing data in the Workshop sample. This was done to preserve the number of subjects in a small sample, but more importantly since the commonly used deletion procedures (e.g. listwise or pairwise) have been shown repeatedly to produce biased or inefficient estimates, and have been advised against by the APA Task Force on Statistical Inference (Baraldi & Enders, 2010; Wilkinson, 1999). Various imputation methods were considered and evaluated for the present procedure. Multiple Imputation (MI) and Expectation-Maximization (EM) were implemented, as they are shown to be superior to other methods for the treatment of missing data (Graham, 2009; Schafer, 1999; Schlomer, Bauman, & Card, 2010). Between the two, MI is preferred over EM because (a) it is shown to perform well with small samples; (b) it is robust to violations of continuity and normality; and (c) it preserves the variance associated with parameter estimates (Allison, 2009; Graham, 2009; Leite & Beretvas, 2010; Schafer, 1999). However, some of the common statistical procedures are not easily performed with MI's multiple sets of data due to the lack of pooled parameters in SPSS or other programs. Lastly, listwise deletion was still considered in the analysis along with MI and EM, to compare the outcomes among the three methods.

Before missing data are treated with any procedure, it is important to determine whether data are missing at random or not (Little & Rubin, 1987; McKnight, McKnight, & Sidani, 2007). While deletion methods are only acceptable when data are missing *completely* at random (MCAR), the imputation techniques assume data are missing at least at random (MAR) or are *ignorable*

(Graham, 2009, 2012). Schafer (2005) explicates missingness mechanisms for cases of dropout, a dominant pattern in the Workshop sample:

- MCAR (missing completely at random) means that the probability of dropout is unrelated to any characteristics of the subject at all.
- MAR (missing at random) means that the probability of dropout may be related to covariates and to pre-dropout responses.
- MNAR (missing not at random) means that probability of dropout is related to responses at the time of dropout. (pp. 18)

In the context of missing data, MCAR is the most desirable situation as it allows for deletion methods, as long as the proportion of missing data is small, and it produces unbiased parameter estimates with imputation procedures (McKnight et al., 2007; Graham, 2009). Little's MCAR test is used to determine if data are MCAR by comparing means of subsamples for each pattern of missing data with the expected population means based on parameter estimates (McKnight et al., 2007). The null hypothesis that data are MCAR is tested with the chi-square statistic. Little's MCAR test was performed on the ITSI subscale data for Attitudes and Actions subscale sets separately – the same data sets that the imputation procedures and subsequent research question analyses are run on. Table 6 shows the chi-square test results. The chi-square test yielded probabilities of .69 and .35 for Attitudes and Actions subscales respectively in the Workshop sample. The null hypothesis was retained and it was concluded that the data in the Workshop sample were missing completely at random, or were MCAR.

Table 6

Little's MCAR Test for the Workshop Sample on Attitudes and Actions Subscales

ITSI subscales	*df*	*Chi-square*	*p*
Attitudes	6	3.934	.686
Actions	6	6.671	.352

Both the EM and the MI models were constructed for the Workshop sample. The EM and MI models were constructed separately for the Attitudes and the Actions ITSI subscales. The separate Attitudes and Actions EM and MI models included both the pre-test and the post-test variables. This approach to imputation modelling was taken to represent the subsequent research question analyses which were performed separately for Attitudes and Actions subscales, with each including the pre-test and post-test variables. Both EM and MI final procedures were performed in SPSS. MI modelling was also performed in AmeliaView package for R software to compare parameter estimation with SPSS.

The EM model had a 500 iterations limit, each procedure converging successfully and producing a single data set with original and imputed values, which was used in later analyses. As mentioned above, unlike MI, the EM procedure does not include variance that is normally present in repeat sampling, although it includes within-variable covariance as a result of repeat iterations. Table 7 presents statistics for a subset of items in the EM procedure performed on the Workshop sample Attitudes subscales. It illustrates the convergence of estimated means and standard deviations between original values and values produced by the EM algorithm through repeat iterations until convergence was reached.

Table 7

Select Item Summary of EM Estimated Means and Standard Deviations in the Workshop Sample

	Original		EM	
ITSI items	*M*	*SD*	*M*	*SD*
Q30_1_1_G1	3.62	0.59	3.62	0.59
Q30_1_1_G3	3.89	0.32	3.89	0.30
Q30_1_2_G1	3.76	0.44	3.76	0.44
Q30_1_2_G3	4.00	0	4.00	0
Q33_1_4_G1	2.67	1.02	2.67	1.02
Q33_1_4_G3	2.89	0.83	2.89	0.77

The MI model included 20 imputations. As originally proposed and generally accepted over the years, the recommended number of 5 imputations was typically based on Little and Rubin's (1987) original work and subsequent writing by Schafer (1999). More recently however, there have been calls for more imputations especially with small samples, as discussed for example in Allison (2009) and Graham, Olchowski, and Gilreath (2007). Considering there is no inherent disadvantage in running more imputations, aside from negligible increase in computing time, the decision was made to use 20 imputations. This large number was used to take advantage of MI's important property as a procedure that incorporates random variance that is present in repeat sampling. The method for the MI procedure as implemented in SPSS was Full Conditional Specification with Markov Chain Monte Carlo (MCMC) performed with 10 iterations (IBM Corporation, 2013b). This method creates an imputation model separately for each variable with missing values, using observed data for initial values and performing 10 iterations of random draws for each of the 20 imputations. Although typically recommended for arbitrary missingness pattern, it was appropriate for the Workshop sample that had a monotone pattern of missing data, as it is a very robust procedure that does not depend on sequencing of variables unlike the

standard monotone methods (IBM Corporation, 2015). Although some subscale data were skewed, MI was performed without transformation due to robustness of the method with skewed variables as demonstrated in simulation studies (von Hippel, 2013). The resulting data consisted of 20 sets of cases in the Workshop sample that is treated by SPSS as an imputed data set and for some procedures produces pooled parameter estimates for the 20 imputations, in addition to separate parameter estimates for each imputed set.

Research Questions Analyses

Research question 1: What are the characteristics of faculty attitudes and practices with regards to inclusive instruction?

Descriptive statistics and multivariate analysis of variance (MANOVA) were used to describe the characteristics of reported attitudes ('Attitudes' in the ITSI instrument) and practices ('Actions' in the ITSI instrument) toward disabilities and inclusive instruction by Carleton University faculty.

Descriptive statistics. The mean was used to present average levels of agreement with statements representing faculty Attitudes and Actions in each of the subscales of the ITSI instrument, pedagogical areas in inclusive instruction or universal design (e.g. Inclusive Lecture Strategies, Table 8). On Attitudes subscales, the mean values of responses show faculty perceptions to be positive, between somewhat agree and agree (3.36 to 3.64), on four out of six scales: Accommodations (ACC), Accessible Course Materials (ACM), Inclusive Lecture Strategies (ILS), and Inclusive Classroom (IC). On these scales faculty are supportive of

statements that reflect attitudes toward allowing accommodations for students with disabilities (ACC), making course materials more accessible through use of technology (ACM), using lecture strategies that promote processing of information (ILS), and incorporating variability and flexibility in the course design (IC). On the Inclusive Assessment (IA) subscale, faculty responses are on average only marginally supportive of statements that endorse flexibility in evaluation methods and deadlines. In contrast to above statements, on average faculty somewhat disagree with allowing extra credit assignments or reducing course work for students with or without disabilities, as reported on the Course Modifications (CM) subscale.

Table 8

Descriptive Statistics and Reliability for Attitudes and Actions Subscales

	Attitudes			Actions		
ITSI subscales	*M*	*SD*	α	*M*	*SD*	α
Accommodations (ACC)	3.48	0.48	0.75	2.82	0.81	0.70
Accessible Course Materials (ACM)	3.37	0.57	0.51	3.15	0.67	0.47
Course Modifications (CM)	1.86	0.71	0.73	1.15	0.69	0.73
Inclusive Lecture Strategies (ILS)	3.64	0.46	0.76	3.22	0.58	0.71
Inclusive Classroom (IC)	3.36	0.50	0.79	2.72	0.62	0.72
Inclusive Assessment (IA)	2.67	0.62	0.62	2.07	0.75	0.57

Note. Attitudes scale: 1 (disagree), 2 (somewhat disagree), 3 (somewhat agree), 4 (agree);
Actions scale: 0 (no opportunity/not applicable), 1 (never), 2 (sometimes), 3 (usually), 4 (always).

On Actions subscales, measuring the prevalence of practices in inclusive instruction, faculty report usually implementing such practices (mean values 2.72 to 3.22). The exception is the CM subscale where faculty on average never use practices related to reducing course work or giving grade raising assignments, which is consistent with their reported attitudes on this scale.

On two subscales, ACM and IA, across both Attitudes and Actions (Table 8), Cronbach's coefficient alpha of internal consistency reliability was lower than the generally acceptable cut-off level of .70 ('modest' as originally termed, Nunnally & Bernstein, 1994, pp. 264-265; Robinson, Shaver, & Wrightsman, 1991). These two subscales have also shown lower alpha levels in previous studies with the ITSI instrument (Lombardi & Sala-Bars, 2013). However, since reliability is not inherent to an instrument, but rather the property of the scores in a given study (Wilkinson, 1999), it was considered worthwhile to examine the low levels of alpha for ACM and IA in the present study.

In spite of its status, it is now generally accepted in psychometric literature that alternatives to coefficient alpha should be considered as it is a lower bound reliability estimate and its assumptions are rarely met in social science research (Green & Yang, 2009; Revelle & Zinbarg, 2009; Sijtsma, 2009). Since the coefficient alpha assumes a restrictive model of internal consistency reliability, the 'essentially tau-equivalent' model (Cortina, 1993; Teo & Fan, 2013), an alternative reliability coefficient *omega* (hierarchical and total) was calculated for each subscale, reported below for Attitudes subscales only (Table 9). While both alpha and omega-hierarchical (ω_h) share the assumption of unidimensionality (single general factor), omega is based on the congeneric model of reliability that does not assume equal item variances and covariances under the factor analytic model (Revelle & Zinbarg, 2009; Dunn, Baguley, & Brunsden, 2014). Furthermore, omega-total (ω_t) represents the proportion of scale variance due to all common factors, including a general factor, as a coefficient of reliability useful in the

analysis of scales that are not strictly unidimensional (Zinbarg, Yovel, Revelle, & McDonald, 2006).

In addition to reporting the omega coefficient, ordinal versions of both alpha and omega are reported in Table 9 in square brackets. As used in the present study and others (Lombardi & Sala-Bars, 2013), items for the ITSI subscales have a 4-point Likert-type response options, representing an ordinal scale. Although ordinal response scales are conventionally used in parametric testing as they exhibit interval-type scale-level characteristics (Carifio & Perla, 2007), there is evidence that the standard calculation of alpha from the Pearson covariance matrix with ordinal data can underestimate the relationship between variables (Gadermann, Guhn, & Zumbo, 2012). Such bias is corrected with the use of the polychoric correlation matrix to calculate alpha and omega for ordinal data (Gadermann et al., 2012).

Table 9

Reliability Coefficients Alpha (α), Omega Hierarchical (ω_h), and Omega Total (ω_t), with Ordinal Versions in Square Brackets, for ITSI Attitudes Subscales

	Attitudes		
ITSI subscales	α [ordinal α]	ω_h [ordinal ω_h]	ω_t [ordinal ω_t]
Accommodations (ACC)	0.75 [0.86]	0.50 [0.60]	0.82 [0.91]
Accessible Course Materials (ACM)	0.51 [0.70]	0.58 [0.71]	0.68 [0.83]
Course Modifications (CM)	0.73 [0.83]	0.62 [0.77]	0.85 [0.92]
Inclusive Lecture Strategies (ILS)	0.76 [0.87]	0.74 [0.84]	0.85 [0.92]
Inclusive Classroom (IC)	0.79 [0.86]	0.72 [0.79]	0.86 [0.92]
Inclusive Assessment (IA)	0.62 [0.70]	0.52 [0.40]	0.80 [0.86]

Differences between omega hierarchical and omega total suggest multidimensionality, or that items comprising the scale load weakly on a general latent factor (Zinbarg et al., 2006). The

issues with dimensionality however, such as evident in ACM and IA as suggested by low ω_h, are not uncommon in research on latent psychological variables; in fact, multidimensionality is the norm (Cortina, 1993; Sijtsma, 2009). An alternative way of evaluating reliability is to examine average inter-item correlations. For ACM, the average inter-item correlation was .25, while for IA it was .29, both within the range of 'extensively' adequate criteria for evaluation of attitude scales (Robinson et al., 1991). It should also be noted that the value of alpha is directly related to the number of items in a scale – the higher the number of items the higher the alpha level (Cortina, 1993) – and the ACM and IA subscales have only 4 items each.

Furthermore, differences between reliability coefficients calculated as continuous versus ordinal data revealed that the use of the 4-point item response options had underestimated the standard (non-ordinal) reliability coefficients calculated from the Pearson covariance matrix. Considering the reliability coefficients alpha and omega based on ordinal data were within satisfactory levels, and given the additional investigation with regards to multidimensionality and inter-item correlations, data analysis for the research questions proceeded with the ITSI scales as originally designed and administered in this study. However, as discussed in the Limitations section in Chapter IV, there is sufficient information provided by the coefficient omega and a preliminary exploratory factor analysis of select subscales to suggest a review of the internal structure of the ITSI subscales in subsequent studies.

Group differences. To explore faculty Attitudes and Actions across various group characteristics, group comparisons were made with the use of multivariate analysis of variance (MANOVA) and relevant tests of group comparison. MANOVA was used for theoretical more

than statistical reasons (i.e., controlling for Type I error; Frane, 2015); specifically to determine if group characteristics such as faculty affiliation or gender were different when examined in relation to the global traits of Attitudes and Actions, each made up of the individual ITSI subscales. While the individual subscales provide more specific information – e.g., ATT_ACC: attitudes toward use of accommodations – it is useful for general discussion and faculty development planning to assess overall dimensions of Attitudes or Actions toward inclusive instruction at the University.

Assumptions. First data were examined for univariate and multivariate assumptions. Box plots revealed values that were identified as outliers (i.e., located beyond the whiskers). In the context of ITSI subscales, those values represent means for individual cases (participants) on the items comprising the subscale. There was one value beyond the 3*IQR (interquartile range) in the variable Attitudes: Inclusive Lecture Strategies (ATT_ILS) and two in Actions: Course Modifications (ACT_CM). These were considered extreme values based on the classic Tukey fences and used by SPSS boxplots. For each of those participants, the actual raw responses that contributed to the mean value for those subscales were examined. All three were real values from the Likert scales used, hence they were not errors – one participant responding with all 1's (lowest value) on ATT_ILS and the two participants responding with all 4's (highest value) on ACT_CM. All three can be considered to represent extreme responding in the context of Likert data and outlier analysis (Zijlstra, van der Ark, & Sijtsma, 2011). However, since the same participants did not respond in the same manner on the other five subscales, they cannot be considered extreme responders overall to justify removal of their data from the sample. To further investigate possible outliers and in the context of multivariate analyses, Mahalanobis

Distance was calculated for Attitudes and Actions subscales (Tabachnick & Fidell, 2013). Three cases on the Attitudes and five on the Actions subscales exceeded the recommended critical chi-square values with 6 degrees of freedom at the significance of $p < .001$. Mahalanobis Distance has been shown in simulation studies on Likert data as having high degree of specificity and sensitivity in detecting multivariate outliers, as well as small bias when values are removed based on its significance (Zijlstra et al., 2011). The cases identified by Mahalanobis Distance as multivariate outliers contain the cases identified via IQR fences as univariate outliers. One case was identified as an outlier within both the Actions and the Attitudes items, resulting in the total of seven potential multivariate outliers. The responses from these seven cases were examined for each of the sixty six total items that comprise the Attitudes and Actions subscales. Similar to the analysis of the univariate outliers based on IQR fences, the responses of the seven potential multivariate outliers revealed meaningful patterns of responses, albeit with extreme responding on some sets of items. For example, one participant responded to 40 out of the total 66 items with the lowest option on Attitudes and Actions subscales, 'disagree' and 'never' respectively. Still, the patterns of responding for this participant were meaningful. Both for the items the participant disagreed with and never implemented, and those items with higher agreement on the Attitudes subscales and higher frequency of implementation on the Actions subscales were consistent (i.e., use of technology and accommodating students with documented disabilities). While the detailed examination of potential outliers led to the conclusion that these cases should not be excluded as outliers, in keeping with the common practices, the subsequent analyses were performed with and without the cases identified as outliers to compare parameter estimates, discussed in the sections below. Where appropriate, robust versions of analytic methods were

used which are not sensitive to outliers (i.e., based on trimmed means and bootstrapping; Field, Miles, & Field, 2012; Wilcox, 2012).

Univariate normality was first assessed visually with histograms and P-P plots. Among Attitudes subscales, all but Inclusive Assessment (ATT_IA) appeared to depart from a normal distribution, while the same was the case for Actions: Inclusive Assessment (ACT_IA) and Actions: Inclusive Classroom (ACT_IC) subscales. To determine if departures from normality should be of concern, the values and standard errors for skew and kurtosis were examined (Table 10 & Table 11). In addition, bootstrapped standard errors and confidence intervals were calculated for the mean, standard deviation, as well as skew and kurtosis. Bootstrapping is a technique used to simulate a sampling distribution with repeat sampling from observed data – in the present study 2000 samples were drawn for each bootstrapped procedure with the use of a 95% BCa (bias and skew corrected) confidence intervals. Due to the sample size, tests of normality were not relied upon as they are considered too sensitive. This is a known property of such tests where the smallest deviation from normality results in significance when the sample size is large and consequently the standard error diminishes (Maxwell & Delaney, 2004, p. 115; Tabachnick & Fidell, 2013, pp. 79-80). This is evident when examining ATT_IA, which is quite clearly normally distributed with a skew of -.026 and kurtosis of .018, and a perfect bell-shaped curvature, and yet both Kolmogorov-Smirnov and Shapiro-Wilks tests are significant with $p > .001$. Instead, the size of skew and kurtosis statistics is assessed according to general guidelines, whereby absolute values between 1 and 2 deserve attention although are still unlikely to significantly bias parameter estimates, and values over 2 are of concern (Miles & Shevlin, 2001, p. 74; Pituch & Stevens, 2016, p. 228). The skewness and kurtosis values for ITSI subscales

were checked for both the overall sample and split by groups that were used for comparison of means. Based on the values >1 for skewness and kurtosis, as well as the visual analysis of histograms and P-P plots, the Attitudes subscales Accessible Course Materials (ATT_ACM) and Inclusive Lecture Strategies (ATT_ILS), and the Actions subscale Course Modifications (ACT_CM) were identified as suspect for departures from normality, and examined with the use of bootstrapped confidence intervals. The bootstrapped confidence intervals did not contain zero values and the upper limits for those three scales did exceed +/-2 confirming these scales were skewed. However, it was also noted that the observed values of the estimates relevant for analysis in Research Question 1, the mean and the standard deviation, were located within the bootstrapped 95% bias-corrected confidence intervals. The significance tests for various analyses were performed with the use of bootstrapped confidence intervals to protect against the impact of skewness in the three variables and overall make significance testing more robust for all other variables.

The above conclusions about the normality assumption and data in the present study were made with the understanding that it is the normality of the sampling distribution of the estimated parameters that matters, and which is only approximated with examination of the distribution of raw data, such as the ITSI subscales. Bootstrapping allowed estimation of parameters based on a simulated sampling distribution. Further to this, it follows from the Central Limit Theorem that with the increasing sample size (> 30 per sample, group, or cell), a sampling distribution of a parameter becomes normalized (Field, 2013; Pituch & Stevens, 2016; Tabachnick & Fidell, 2013). Lastly, ANOVA as well as subsequent regression analyses were shown to be quite robust to violations of normality (Norman, 2010; Pituch & Stevens, 2016, p. 225).

Table 10

Mean, Standard Deviation, Skewness, and Kurtosis with Bootstrap for ITSI Attitudes Subscales

			95% bootstrap confidence intervals	
	ITSI subscales	*Statistic*	*Lower*	*Upper*
Mean	ATT_ACC	3.479	3.427	3.535
	ATT_ACM	3.372	3.309	3.436
	ATT_CM	1.860	1.785	1.946
	ATT_ILS	3.644	3.593	3.694
	ATT_IC	3.359	3.305	3.415
	ATT_IA	2.666	2.596	2.735
Std. Deviation	ATT_ACC	0.482	0.440	0.520
	ATT_ACM	0.573	0.509	0.633
	ATT_CM	0.707	0.653	0.757
	ATT_ILS	0.464	0.414	0.514
	ATT_IC	0.499	0.454	0.540
	ATT_IA	0.619	0.574	0.663
Skewness	ATT_ACC	-1.049	-1.381	-0.708
	ATT_ACM	-1.224	-1.607	-0.677
	ATT_CM	0.685	0.496	0.854
	ATT_ILS	-1.607	-2.288	-1.006
	ATT_IC	-1.046	-1.305	-0.754
	ATT_IA	-0.026	-0.258	0.193
Kurtosis	ATT_ACC	0.862	-0.048	1.728
	ATT_ACM	2.496	0.813	3.700
	ATT_CM	-0.036	-0.437	0.379
	ATT_ILS	3.462	0.346	6.298
	ATT_IC	0.960	0.258	1.627
	ATT_IA	0.018	-0.289	0.384

Note. Accommodations (ACC), Accessible Course Materials (ACM), Course Modifications (CM), Inclusive Lecture Strategies (ILS), Inclusive Classroom (IC), Inclusive Assessment (IA).

Table 11

Mean, Standard Deviation, Skewness, and Kurtosis with Bootstrap for ITSI Actions Subscales

			95% bootstrap confidence intervals	
	ITSI subscales	*Statistic*	*Lower*	*Upper*
Mean	ACT_ACC	2.823	2.733	2.917
	ACT_ACM	3.151	3.073	3.228
	ACT_CM	1.155	1.081	1.229
	ACT_ILS	3.217	3.152	3.277
	ACT_IC	2.723	2.661	2.789
	ACT_IA	2.074	1.989	2.160
Std. Deviation	ACT_ACC	0.807	0.734	0.873
	ACT_ACM	0.670	0.615	0.720
	ACT_CM	0.693	0.623	0.758
	ACT_ILS	0.582	0.541	0.622
	ACT_IC	0.621	0.580	0.660
	ACT_IA	0.746	0.685	0.806
Skewness	ACT_ACC	-0.931	-1.183	-0.584
	ACT_ACM	-0.776	-0.999	-0.519
	ACT_CM	1.042	0.666	1.328
	ACT_ILS	-0.545	-0.870	-0.214
	ACT_IC	-0.250	-0.437	-0.055
	ACT_IA	-0.115	-0.426	0.187
Kurtosis	ACT_ACC	1.130	0.413	1.820
	ACT_ACM	0.531	-0.091	1.174
	ACT_CM	2.222	0.941	3.362
	ACT_ILS	-0.004	-0.709	0.690
	ACT_IC	-0.483	-0.715	-0.204
	ACT_IA	0.473	0.085	0.837

Note. Accommodations (ACC), Accessible Course Materials (ACM), Course Modifications (CM), Inclusive Lecture Strategies (ILS), Inclusive Classroom (IC), Inclusive Assessment (IA).

The assumption of equality of variances across different levels of independent variables in the present study was assessed individually for each analysis performed. Since multivariate analyses were utilized, equality of covariance matrices, and where appropriate, univariate homoscedasticity were assessed. The relevant results are reported separately for each analysis below. The assumptions concerning the linearity and multicollinearity of the dependent variables were satisfied as a result of ITSI subscales being a product of factor analysis, hence achieving the balance between necessary yet not redundant linear relationships. Lastly, the assumption of independence of observations was considered to be satisfactory through research design where each participant separately and independently filled out the ITSI survey.

Mean differences. Based on prior research, there was interest, articulated in Research Question 1, to investigate mean differences among various demographic groups of faculty with respect to attitudes and practices in inclusive instruction. To this end, a number of multivariate analyses of variance (MANOVA) were conducted. A few points of clarification are in order. MANOVA was conducted rather than a series of α-adjusted univariate analyses strictly because the ITSI subscales are grouped in a general, conceptually related system of variables, namely Attitudes or Actions toward inclusive instruction (Huberty & Morris, 1989; Pituch & Stevens, 2016). As such, the subscales are correlated but not overly so to make them redundant, which is the outcome of the factor analysis work by Lombardi (2010) in developing the ITSI instrument. Table 12 and Table 13 present correlations for Attitudes and Actions ITSI subscales. An omnibus test in MANOVA allows conclusions about group differences among the university faculty members with regards to the overall dimension of Attitudes or the overall dimension of Actions in inclusive instruction.

Table 12

Correlations between ITSI Attitudes Subscales

ITSI subscales	1	2	3	4	5	6
1. Accommodations (ACC)	–					
2. Accessible Course Materials (ACM)	.318**	–				
3. Course Modifications (CM)	.480**	.168**	–			
4. Inclusive Lecture Strategies (ILS)	.298**	.262**	.167**	–		
5. Inclusive Classroom (IC)	.417**	.426**	.287**	.508**	–	
6. Inclusive Assessment (IA)	.394**	.211**	.498**	.348**	.482**	–

** $p < .01$.

Table 13

Correlations between ITSI Actions Subscales

ITSI subscales	1	2	3	4	5	6
1. Accommodations (ACC)						
2. Accessible Course Materials (ACM)	.296**					
3. Course Modifications (CM)	.431**	.012				
4. Inclusive Lecture Strategies (ILS)	.181**	.124*	.078			
5. Inclusive Classroom (IC)	.315**	.373**	.168**	.375**		
6. Inclusive Assessment (IA)	.311**	.223**	.404**	.197**	.431**	

* $p < .05$. ** $p < .01$.

To control the familywise error rate in the context of the present research question, 'family' was defined as the family of group comparisons performed per each MANOVA analysis. Selection of multiple MANOVA analyses was driven by theory and prior research to define the scope of the multivariate null hypothesis within each MANOVA. Multiple comparisons and their α adjustment were then located within the family bounded by the scope of each multivariate null

hypothesis (Matsunaga, 2007; Maxwell & Delaney, 2004, p. 194). As such, α-adjusted univariate or post-hoc tests were performed following significant omnibus tests, with step-down α adjustment to maximize power (Frane, 2015).

One other consideration was the type of follow-up analyses after significant MANOVA. Performing multiple univariate ANOVAs has been and still remains the practice of choice, in spite of growing criticism and recognition that MANOVA and ANOVA ask different questions (Enders, 2003; Warne, 2014). Specifically the issue is that MANOVA tests a linear combination of the dependent variables, which can be understood as identifying a common latent variable among multiple dependent variables, then testing differences across groups on this latent variable. In contrast, a univariate ANOVA does not account for such intercorrelations among dependent variables because it performs a separate test on each dependent variable. While the use of α-adjustment addresses the issue of familywise error rate, the argument still remains that univariate ANOVA analysis is not an appropriate procedure to follow significant MANOVA in order to determine on which dependent variable the groups differ. Discriminant (function) analysis is recommended as a follow up procedure to significant MANOVA because it continues to utilize a linear relationship among all the dependent variables to determine which of them most contribute to the differences across the groups (Field, 2013; Tabachnick & Fidell, 2013). However, discriminant analysis becomes too difficult to interpret in cases of multilevel factorial designs (Pituch & Stevens, 2016; Warne, 2014). In the context of the present study, post-hoc pairwise comparisons were the main follow-up procedures with limited use of discriminant analysis, for primarily conceptual reasons. As mentioned previously, MANOVA was used because ITSI subscales were identified as components of a more general concept, Attitudes (or

Actions) toward inclusive instruction and there was interest in examining group difference at the level of the two general dimensions. If it was determined that various groups of faculty differ on one of these two dimensions with an omnibus MANOVA test, then the question of interest would become about more specific areas (the ITSI subscales) within the context of the general concept (Huberty & Morris, 1989), and how the groups differ on each of those specific areas in order to inform the focus of faculty development activities. While it is acknowledged that the ITSI subscales are necessarily correlated, examining various linear combinations (functions) through discriminant analysis would not have been very meaningful. ITSI subscales being composite Likert questionnaire scales are the products of factorial analyses (Lombardi, 2010; Lombardi et al., 2013), the method used in discriminant analysis. In other words, an ITSI subscale is methodologically equivalent to a function in discriminant analysis. But more so, linear combinations of dependent variables, the functions in discriminant analyses, are not by themselves readily meaningful (i.e., they are undefined latent variables, unlike already conceptually defined ITSI subscales). And while it could have been useful to determine through discriminant analysis which of the dependent variables (ITSI subscales) contributes the most to group differences in a linear relationship, such determination would have been arbitrary as a matter of degrees among standardized discriminant function coefficients (Pituch & Stevens, 2016). These considerations were important because the reason for the group analyses in Research Question 1 was to determine what aspects of inclusive instruction, as represented by ITSI subscales, should be the focus of faculty development activities for which groups of faculty, based on their differences. For this reason the primary follow-up procedures for MANOVA analyses performed for the present research question were post-hoc pairwise comparisons, with the use of discriminant analysis only where it was conceptually meaningful. The results for the

post-hoc pairwise comparisons are reported with reference to either p-values or the bootstrapped confidence intervals. As discussed earlier, due to suspected departures from normality of two Attitudes and one Actions subscale, as well as to make all pairwise comparisons more robust, 95% bias-corrected bootstrapped confidence intervals were examined for each comparison.

In the first multivariate analysis, MANOVA (1), gender was used as the single factor and the six Attitudes subscales as dependent variables. Prior research has found female faculty to have more positive attitudes toward provision of accommodations and knowledge of disabilities than male faculty (Alliston, 2011; Cook et al., 2009; Lombardi & Murray, 2011; Murray, Wren, et al., 2008). This finding was not replicated in the present study as the omnibus tests for MANOVA (1) were not significant, with Pillai's Trace (V) = 0.023, F(6, 307) = 1.225, p = 0.293, ηp^2 (partial eta-squared) = 0.02. Note that Pillai's Trace (symbol V) is used here as the reference multivariate test of significance due to its demonstrated robustness to violations of multivariate assumptions of normality and outliers (Field et al., 2012; Finch & French, 2013), with other assumptions being satisfied.

In MANOVA (2), gender was again used as the independent variable and the six Actions subscales as dependent variables. No significant differences in the multivariate combination of the Actions subscales based on gender were found, with V= 0.026, F(6, 307) = 1.342, p = 0.238, ηp^2 = 0.02. Both MANOVA (1) and MANOVA (2) were re-run without the previously identified three candidates for multivariate outliers, with no impact on the results. Box's M test for equality of covariance matrices was non-significant in each analysis, satisfying the requirement for multivariate homoscedasticity.

Previous studies have found differences on faculty attitudes toward disability-related accommodations and teaching practices, based on faculty rank and affiliation (Alliston, 2011; Bourke et al., 2000; Gitlow, 2001; Leyser et al., 2011; Lombardi & Murray, 2011; Nelson et al., 1990; Skinner, 2004). The two factors were recoded based on prior research and to maximize cell size (>30). Rank was divided into tenure and non-tenure. In the present study, based on the options for rank on the ITSI survey (Question #13), faculty were grouped into tenured and non-tenured, as follows:

a) Tenure: Full Professor, Associate Professor, Assistant Professor, Adjunct Professor, Professor Emeritus/Post-retire; and
b) Non-tenure: Full-time Instructor, Contract Instructor.

Since the nature of rank, tenure or non-tenure, can depend on a faculty unit, rank and faculty unit were entered as independent variables into a 2x4 factorial MANOVA. For the Faculties factor, Science and Engineering were combined based on prior research that has found similarities between those two faculties in attitudes toward accommodating students with disabilities. Examination of α-adjusted pairwise comparisons confirmed no significant differences between the Faculties of Science and Engineering on Attitudes and Actions subscales. The other categories were retained as originally collected. A single case was collected for one Faculty unit, Faculty of Graduate and Postdoctoral Studies, and was removed from the analyses (Table 14).

Table 14

Factor Levels for Rank and Faculties in MANOVA(3) and MANOVA(4)

Factors	Levels	N
Rank	Tenure	164
	Non-tenure	149
Faculties	Arts and Social Sciences	147
	Science and Engineering	72
	Public Affairs	63
	Business	31

To examine main effects and interactions for Rank and Faculties, with Attitudes and Actions subscales as dependent variables, MANOVA (3) and MANOVA (4) were performed. As with previous analyses, here again the analyses were performed with and without the cases that were identified as candidates for multivariate outliers. No change was observed in multivariate, univariate, or post-hoc tests of significance. Using $p < 0.001$ as the significance level recommended for the overly sensitive Box's *M* test with large samples (Tabachnick & Fidell, 2013; p. 254), the two MANOVAs with multivariate outliers produced non-significant Box's *M* in both cases. As such, results for MANOVA (3) and MANOVA (4) include the outliers.

MANOVA (3) identified significant differences in the multivariate combination of the Attitudes subscales based on Rank, with $V = 0.053$, $F(6, 300) = 2.774$, $p = 0.012$, $\eta p^2 = 0.05$, and Faculties, with $V = 0.191$, $F(18, 906) = 3.432$, $p < 0.001$, $\eta p^2 = 0.06$. Multivariate interaction was not significant. Since only the main effects were significant, post-hoc pairwise comparisons were performed separately for Rank and Faculties. Examination of univariate ANOVAs was deferred in favour of post-hoc comparisons to examine specific differences among the levels of

independent variables, with adjustment of α levels and the resulting control of Type I error (Maxwell & Delaney, 2004, p. 236). For Rank, with only two groups, Bonferroni corrected pairwise comparisons of estimated marginal means adjusted for the Faculties factor was performed. With the exception of ATT_ACM, Attitudes subscales means of non-tenured faculty were significantly higher than the means of tenured faculty, with the following p values based on 95% bias-corrected bootstrapped confidence intervals: Accommodations (ATT_ACC) $p = .019$; Accessible Course Materials (ATT_ACM) $p = .069$; Course Modifications (ATT_CM) $p = .009$; Inclusive Lecture Strategies (ATT_ILS) $p = .039$; Inclusive Classroom (ATT_IC) $p < .001$; and Inclusive Assessment (ATT_IA) $p = .006$.

To further investigate which among the six ITSI Attitude subscales contributed to the differences in means between tenured and non-tenured faculty, discriminant analysis was performed. The standardized discriminant function coefficients were examined rather than structural coefficients as they more accurately identify variables contributing to the discriminant function (Pituch & Stevens, 2016, p. 396). Positive values of a variable contributing to the function indicate a positive relationship of participant scores on the discriminant function and the variable, while negative values indicate a negative relationship. Standardized discriminant function coefficients with an absolute value larger than 0.3 are considered to make significant contribution to the discriminant function (Pituch & Stevens, 2016, p. 395 & p. 402). Based on standardized discriminant function coefficients (Table 15) it was evident that ATT_IC had by far the largest contribution to the formation of the discriminant function to differentiate between tenured and non-tenured faculty. These results suggest the need to focus faculty development activities on tenured faculty most notably in Inclusive Classroom, consisting of inclusive instructional

practices represented by the presentation of course content in multiple formats, variety in classroom activities, and use of technology to facilitate course activities.

Table 15

Standardized Discriminant Function Coefficients for ITSI Attitude Subscales on Rank

ITSI Attitudes subscales	Function 1
Accommodations (ACC)	-.167
Accessible Course Materials (ACM)	.233
Course Modifications (CM)	.304
Inclusive Lecture Strategies (ILS)	-.178
Inclusive Classroom (IC)	.888
Inclusive Assessment (IA)	.051

Following the other significant main effect in MANOVA (3) for the Faculties factor with four groups, Hochberg's GT2 post-hoc test was used as it is the recommended procedure when cell sizes are unequal and multivariate homoscedasticity is achieved (Field, 2013). It is also a procedure that uses a stepwise approach to control Type I error and to maximize power (Frane, 2015). Additionally, the more traditional Tukey HSD was performed alongside Hochberg's GT2 and no differences between the two procedures were identified. The Faculty of Arts and Social Sciences had a significantly higher mean on Inclusive Classroom (ATT_IC) compared to the Faculty of Public Affairs ($p = .042$), as well as the Faculties of Science and Engineering based on the bootstrapped confidence intervals (95% CI [0.037, 0.318])[4]. The Faculty of Arts and Social Sciences was also significantly higher on Inclusive Assessment (ATT_IA) compared to the Faculties of Science and Engineering ($p < .001$), and again based on bootstrapped 95%

[4] Bootstrapped post-hoc analyses in SPSS only report confidence intervals, without the corresponding *p* values.

confidence intervals, also higher than the Faculties of Public Affairs [0.046, 0.392][5] and Business [0.043, 0.449]. Similarly, on the subscale of Inclusive Lecture Strategies (ATT_ILS), the mean for the Faculty of Arts and Social Science was significantly higher than the mean for the Faculty of Public Affairs [0.035, 0.306]. The Faculties of Science and Engineering had a significantly lower mean on the Accommodations (ATT_ACC) subscale than both the Faculty of Arts and Social Sciences ($p < .001$) and the Faculty of Public Affairs ($p < .001$). The 95% bias-corrected confidence intervals also revealed that the Faculties of Science and Engineering had lower means than the Business faculty on ATT_ACC [-0.426, -0.037]. On the subscale of Accessible Course Materials (ATT_ACM), Faculty of Business had a significantly higher mean than all the other Faculties; the Faculty of Arts and Social Science ($p = .043$), the Faculties of Science and Engineering [0.028, 0.440], and the Faculty of Public Affairs [0.124, 0.510]. These results suggest the Faculty of Arts and Social Sciences endorse attitudes toward inclusive instruction higher than other Faculties across a number of subscales, with the exception of Accessible Course Materials where the Faculty of Business is significantly higher. They also indicate the need to focus faculty development efforts to address lower agreement with attitudes supporting accommodations, inclusive classroom practices, and flexibility in assessment in the Faculties of Science and Engineering, and attitudes related to inclusive classroom practices, lecture strategies, and assessment in the Faculties of Business and Public Affairs.

MANOVA (4) identified significant differences in the multivariate combination of the Actions subscales based on Rank, with $V = 0.063$, $F(6, 300) = 3.353$, $p = 0.003$, $\eta p^2 = 0.06$, and Faculties, with $V = 0.127$, $F(18, 906) = 2.217$, $p = 0.003$, $\eta p^2 = 0.04$. Multivariate interaction of Rank by Faculties was also significant with $V = 0.094$, $F(18, 906) = 1.621$, $p = 0.049$, $\eta p^2 = 0.03$. Since the

[5] The subsequent 95% confidence intervals are reported with square brackets without the leading '95% CI'.

multivariate interaction was significant, Hochberg's GT2 alongside Tukey HSD post-hoc tests for simple main effects were performed to investigate the differences in means among the three groups in Faculties factor at each level of Rank. For *tenured* faculty, Hochberg's GT2 post-hoc tests identified that the means on Actions subscales for the faculties of Science and Engineering were significantly lower on Accommodations (ACT_ACC) than the Faculty of Public Affairs ($p = .035$), Faculty of Arts and Social Sciences [-0.698, -0.044], and the Faculty of Business [-0.909, -0.075]. The Faculties of Science and Engineering were also lower than the Faculty of Public Affairs on Classroom Modifications (ACT_CM, $p = .036$) and the Faculty of Arts and Social Sciences on Inclusive Assessment (ACT_IA, $p = .010$). In addition to scoring higher than the Faculties of Science and Engineering, the Faculty of Public Affairs also scored higher on ACT_CM than the Faculty of Arts and Social Sciences [0.005, 0.567] and the Faculty of Business [0.110, 0.785]. For *non-tenured* faculty, Hochberg's GT2 post-hoc tests for Actions subscales showed that the Faculty of Arts and Social Sciences had a significantly higher mean than the Faculties of Science and Engineering ($p = .041$) and the Faculty of Public Affairs [0.028, 0.749] on the ACT_ACC subscale, and the Faculties of Science and Engineering [0.042, 0.627] on Inclusive Assessment (ACT_IA). The faculty of Arts and Social Sciences also had a significantly higher mean than the Faculties of Business [0.183, 0.676] and Public Affairs [0.025, 0.727] on the ACT_CM subscale, and the Faculty of Business on Inclusive Classroom (ACT_IC, [0.021, 0.761]) and Inclusive Assessment (ACT_IA, [0.106, 0.763]) subscales. In contrast to the other findings, on the ACT_CM subscale the combined Faculties of Science and Engineering had a significantly higher mean than the Faculty of Business [0.033, 0.636]. In summary, when it comes to instructional practices that were reported as being presently implemented, both tenured

and non-tenured faculty in the Arts and Social Sciences more commonly use such instructional strategies across different areas than any other Faculty at the University.

In the last set of MANOVA analyses, participants were compared on the basis of their experience with disabilities. Prior research findings suggest that faculty with more experience teaching students with disabilities (SWDs) have more positive attitudes toward students with disabilities and the provision of accommodations (Leyser et al., 2003; Rao, 2004). Two independent variables were used for MANOVA (5) and MANOVA (6): personal experience of disability (e.g., having a disability oneself) and number of SWDs taught (Table 16). For SWD Taught, there were only 8 participants who indicated they did not teach any students with disabilities in the past. They were combined with participants who indicated they did not know if they taught any students with disabilities. MANOVA (5) was run with Attitudes subscales and MANOVA (6) was run with Actions subscales as dependent variables. Both analyses were performed with and without the cases previously identified as possible multivariate outliers. No significant differences were observed in omnibus tests, p-values, effect sizes, or Box's *M* with and without the outliers for MANOVA (5) with Attitudes subscales. However, for MANOVA (6) with Actions subscales, with and without the outliers, the equality of covariance matrices was not satisfied. Considering that Box's *M* was at $p < 0.001$, the significance level recommended for the overly sensitive Box's *M* test with large samples (Tabachnick & Fidell, 2013, p. 254) was not reached, the cell sizes were unequal, and there were possible multivariate outliers, the decision was made to perform robust MANOVA analyses.

Table 16

Factor Levels for Disability Experience and SWD Taught in MANOVA(5) and MANOVA(6)

Factors	Levels	N
Disability Experience	No	51
	Yes	263
SWD Taught	None or Don't know	38
	Fewer than 5	57
	Five to 20	111
	Over 20	108

For the robust MANOVA (5) and MANOVA (6), the procedure used was the Munzel-Brunner method (*mulrank* R procedure; Field et al., 2012, 16.7 section; Wilcox, 2012, p. 431), which is a multivariate one-way rank-based ANOVA. Since it requires a single independent variable, and since Disability Experience was non-significant in a preliminary multivariate analysis, SWD Taught was used as the single independent variable in the two robust MANOVA analyses. Robust MANOVA is not biased when parametric assumptions are violated, therefore both analyses were performed with the multivariate outliers included in the data. There were significant differences across the four groups of SWD Taught on a multivariate combination of Attitude subscales, $F = 2.25$, $p = 0.001$, and Action subscales, $F = 2.04$, $p = .015$.

Following the significant robust MANOVA (5) and MANOVA (6), robust one-way ANOVA analyses by SWD Taught were performed for each of the dependent variables (Table 17 and Table 18). The robust ANOVA is protected against violations of the usual parametric assumptions and controls for Type I error with the use of trimmed means and bootstrapping

(*t1waybt*; Wilcox, 2012). The results indicated that faculty differ across the four groups of the independent variable (SWD Taught) on ATT_ACC, ATT_CM, ACT_ACC, and ACT_IC.

Table 17

Robust One-Way ANOVAs (t1waybt; Wilcox, 2012) by SWD Taught for Attitudes Subscales

ITSI Attitudes Subscales	F	*p*	Effect size
Accommodations (ACC)	2.92	0.04*	0.26
Accessible Course Materials (ACM)	1.08	0.36	0.15
Course Modifications (CM)	5.54	0.003**	0.31
Inclusive Lecture Strategies (ILS)	0.65	0.58	0.16
Inclusive Classroom (IC)	0.63	0.58	0.13
Inclusive Assessment (IA)	0.86	0.49	0.18

*p<.05; **p<.01

Table 18

Robust One-Way ANOVAs (t1waybt; Wilcox, 2012) by SWD Taught for Actions subscales

ITSI Actions Subscales	F	*p*	Effect size
Accommodations (ACC)	3.01	0.04*	0.23
Accessible Course Materials (ACM)	0.33	0.81	0.12
Course Modifications (CM)	2.31	0.09	0.20
Inclusive Lecture Strategies (ILS)	0.57	0.64	0.12
Inclusive Classroom (IC)	3.16	0.04*	0.26
Inclusive Assessment (IA)	2.53	0.07	0.26

*p<.05

To investigate the mean differences contributing to significant robust ANOVA analyses on ATT_ACC, ATT_CM, ACT_ACC, and ACT_IC, robust post-hoc tests were performed with

pairwise comparisons based on trimmed means and 95% bootstrapped confidence intervals adjusted for multiple comparisons (*linconb* R procedure; Wilcox, 2012, p. 331). Pairwise comparisons reveal that faculty who worked with 1-5 SWDs had a significantly higher mean [-0.493, -0.005] on ATT_ACC than faculty who never worked with SWDs in the past. For ATT_CM the faculty who worked with 1-5 students endorsed beliefs at a higher level than faculty who never worked with SWDs [-0.876, -0.069], but interestingly also had higher means than faculty who worked with 5-20 and over 20 students in the past [0.019, 0.715], [0.151, 0.796]. Faculty who had worked with over 20 students in the past had a higher mean on ACT_ACC than those who worked with 1-5 students [-0.834, -0.006], and on ACT_IC than those who never worked with SWDs [-0.780, -0.001]. In summary, there were differences among faculty members at Carleton University based on how many SWDs they taught in the past, specifically on their attitudes toward accommodations and course modifications, and teaching practices in areas of accommodation and inclusive instruction.

Research question 2. Are there discrepancies between faculty attitudes and practices in inclusive instruction?

As mentioned in the review of the literature, while faculty endorse attitudes related to inclusive instructional practices, such as those recommended by universal design models, there have been reports in the literature that faculty do not implement such practices in line with their attitudes (Cook et al., 2009; Lombardi et al., 2011). Lombardi et al. (2011) were the first to investigate these claims and compare attitudes with actions to determine if there were significant discrepancies between the two. While they determined there were significant differences with the

use of the chi-square analyses, the conclusions made about the nature of those differences were based on visual observation of the patterns of proportions for each subscale between Attitudes and Actions. They concluded that on four out of six subscales Attitudes and Actions were consistent; however on two subscales they reported counterintuitive findings – higher proportions of practices than the related attitudes. Discrepancies between attitudes and practices in inclusive instruction are relevant with respect to the focus of faculty development programs and institutional supports. A different approach would be required to address attitudes in specific areas of inclusive instruction compared to faculty development activities focused on practical implementation.

For Research Question 2, proportions of faculty responses on Attitudes and Actions were compared for each of the six ITSI subscales. If faculty responses were fully consistent between Attitudes and Actions, it was expected to see equal (or not significantly different) proportions in the response categories between Attitudes and Actions. Observed differences between Attitudes and Actions proportions were tested for significance with the chi-square (χ^2) tests. Cramer's *V* is reported as an effect size statistic indicating a proportion between 0 and 1, as a stable alternative to the contingency coefficient (Field, 2013, 18.3.5 section). As some of the expected frequencies were less than 5, Fisher's exact test was also performed along with the chi-square test (Howell, 1995, p. 368). Since Attitudes and Actions are measured on different Likert scales, the responses for individual questionnaire items were recoded into No (0), Maybe (1), and Yes (2). The recoding rule was adopted from Lombardi et al. (2011) to allow for a meaningful comparison of results in the present study with the previous findings. For Attitudes subscales, 1 (disagree) was coded as No, 2 (somewhat disagree) and 3 (somewhat agree) were coded as Maybe, and 4

(agree) was coded Yes. For Actions subscales, 0 (no opportunity) and 1 (never) were coded as No, 2 (sometimes) was coded Maybe, and 3 (usually) and 4 (always) were coded Yes. The newly coded item responses (0, 1, 2) were then combined into subscale scores by taking the mean and rounding to zero decimal places. This resulted in subscale scores with the three response values (0, 1, 2). These subscale scores were counted and used as frequencies in the analyses for Research Question 2, as shown in Table 19.

Table 19 shows frequencies of the three response categories for the six subscales of Attitudes and Actions. We can observe more faculty endorsed Attitudes with a 'Yes' response on the subscales of Accommodations (ACC), Inclusive Classroom (IC), and Inclusive Assessment (IA) than they did Actions on the same subscales. The reverse was the case for subscales of Accessible Course Materials (ACM) and Inclusive Lecture Strategies (ILS) with more faculty reporting use of those practices than they endorsed with 'Yes' responses on the Attitudes dimension for the same subscales. Lastly on the Course Modifications (CM) subscale, a higher proportion of faculty responded 'No' on Actions than the proportion of faculty who responded 'No' on the Attitudes CM subscale. Chi-square test was significant for each of the six subscales at $p < 0.001$, confirmed by the Fisher's exact test, indicating the differences in proportions on response categories for each subscale between Attitudes and Actions were significant. Stated more formally with regards to the chi-square statistic, the proportion of No, Maybe, and Yes responses were not independent of Attitudes and Actions – there was an association between Attitudes and Actions in the pattern of responses of No, Maybe, and Yes.

Table 19

Frequencies of Attitudes and Actions Subscales with Chi-square and Effect Size Statistics

	Attitudes			Actions				
	No	Maybe	Yes	No	Maybe	Yes	$\chi 2$	*V*
ACC	0 (0%)	90 (29%)	224 (71%)	10 (3%)	124 (40%)	180 (57%)	43.37††	0.37
ACM	4 (1%)	94 (30%)	216 (69%)	4 (1%)	69 (22%)	241 (77%)	259.93††	0.64
CM	113 (36%)	181 (58%)	20 (6%)	217 (69%)	85 (27%)	12 (4%)	117.53††	0.43
ILS	1 (0%)	68 (22%)	245 (78%)	1 (0%)	31 (10%)	282 (90%)	340.81††	0.74
IC	3 (1%)	133 (42%)	178 (57%)	8 (2.5%)	158 (50%)	148 (47%)	182.25††	0.54
IA	10 (3%)	232 (74%)	72 (23%)	38 (12%)	216 (69%)	60 (19%)	131.55††	0.46

Note. Accommodations (ACC), Accessible Course Materials (ACM), Course Modifications (CM), Inclusive Lecture Strategies (ILS), Inclusive Classroom (IC), Inclusive Assessment (IA).

†† $p < .001$.

The exact nature of this association was analyzed by examining the observed cell counts, evaluated for significance against the expected frequencies for a given cell (Table 20). The differences in observed versus expected counts were evaluated on the basis of the adjusted standardized residuals for each cell, which are normally distributed; i.e. if an adjusted standardized residual value is larger than +/- 1.96, the difference between the observed and expected cell value is significant at α 0.05 (Sharpe, 2015). The positive and negative sign of the adjusted standardized residual value indicate whether the observed counts were larger or smaller than the expected counts. Only the two definite response categories (No and Yes) were examined in the contingency table, following the same approach by Lombardi et al. (2011), which allows for unambiguous interpretation of patterns of association between Attitudes and Actions by excluding the Maybe category. This analysis revealed a consistent pattern between responses on the Attitudes subscales and the responses on the Actions subscales. On each of the six subscales,

more faculty than expected reported high level of agreement with attitudes and high frequency of the related practices, responding 'Yes' on both Attitudes and Actions. Similarly, with the exception of the Accommodations (ACC) subscale with zero counts for the 'No' responses, on all the other subscales more faculty than expected reported low agreement with attitudes and low frequency of the related practices, responding 'No' on both Attitudes and Actions. This suggests consistency between high endorsement of attitudes and frequent use of related practices, i.e. consistency between Attitudes and Actions across all subscales. This is evident when examining the counts for high levels of agreement on attitudes, the 'Yes' response on Attitudes, and low implementation in practice, the 'No' response on Actions. On none of the subscales were the observed frequencies significantly higher than what is expected under the assumption of no relationship, in fact on CM and IA the observed counts were significantly lower than expected. Lastly, the contradictory findings from Lombardi et al. (2011) where low attitudes on some subscales surprisingly had high frequency of related actions were not replicated in this study. There were zero counts on all six subscales for the 'No' response on Attitudes and 'Yes' response on Actions.

Table 20

Contingency Table of Attitudes by Actions with Cell Counts, and Standardized Residuals in Brackets

	Actions											
	ACC		ACM		CM		ILS		IC		IA	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Attitudes												
No	0 (-)	0 (-)	3†† (13.2)	0 (-)	110†† (8.1)	0 (-)	1†† (17.7)	0 (-)	3†† (10.8)	0 (-)	9†† (7.7)	0 (-)
Yes	7 (-0.1)	154†† (6.5)	0 (-)	199†† (9.6)	5†† (-4.4)	7†† (7.5)	0 (-)	232†† (5.4)	0 (-)	120†† (8.2)	2† (-2.8)	39†† (8.6)

* $p < .05$. † $p < .01$. †† $p < .001$.

Research question 3. Is there a relationship between disability-related training and faculty attitudes, practices, and knowledge in inclusive instruction?

This research question was addressed through two series of single factor MANOVA analyses. In the first series, the independent variable was the type of disability-related training received in the past (TDT), with three levels as No Training, Workshop or Course, and Other Training (Table 21). Data were coded by these three levels to reflect the purpose of the present research study, which seeks to inform faculty development activities, with specific interest in the utility of workshops or courses such as the AODA Accessible Learning workshop at Carleton University. It is important to note that the faculty belonging to the workshop/course group on the TDT variable may have also received other forms of disability-related training. For the dependent variables, MANOVA (1) included Attitudes subscales, and MANOVA (2) examined Actions subscales. In addition to the Attitudes and Actions subscales, the main focus in the present research study, a separate MANOVA (3) analysis was performed on two Knowledge subscales from the ITSI instrument, Disability Law and Concepts (DLC) and Campus Resources (CR). As mentioned in the Methods section, this was done because disability-related training has been traditionally focused on faculty *knowledge* about disabilities and accommodations.

Table 21

Factor Levels for Type of Disability Training in MANOVA (1), (2), (3)

Factor	Levels	N
Type of Disability Training (TDT)	No training	146
	Workshop or course	124
	Other training	44

In the second series of single factor MANOVA analyses, the independent variable was the extent of training received, classified as hours of disability-related training (HDT) with three levels (Table 22). Once again, because workshops and courses as a method of faculty development is of particular interest in the present study, the levels of hours distinguish between up to three hours which is equivalent to one or two workshops, and more than three hours to represent courses and more extensive training experiences. As with MANOVA analyses for Type of Disability Training, the MANOVA analyses for Hours of Disability Training were performed separately for Attitudes, Actions, and Knowledge subscales. A factorial MANOVA that includes TDT and HDT as independent variables in the same model was considered but was decided against since interactions between certain levels of TDT and HDT are not conceptually meaningful. In part the decision was made due to the fact that robust multivariate methods are at present time best implemented for single factor multivariate models (Wilcox, 2012).

Table 22

Factor Levels for Hours of Disability Training in MANOVA (4), (5), (6)

Factor	Levels	N
Hours of Disability Training (HDT)	No training	146
	Up to 3 hours	99
	More than 3 hours	69

The three MANOVA analyses for Type of Disability Training (TDT) as the independent variable, indicated significant results on the multivariate combination of Actions subscales, V= 0.07, F(12, 614) = 1.867, p = 0.036, ηp^2 = 0.04, and Knowledge subscales, V= 0.110, F(4, 622) = 9.078, p = 0.001, ηp^2 = 0.06. However, for Attitudes subscales the omnibus tests of choice,

Pillai's Trace, was not significant, V= 0.053, F(12, 614) = 1.406, p = 0.158, ηp^2 = 0.03, while Roy's Largest Root was significant at exactly 0.05 α level, λ_L = 0.042, F(6, 307) = 2.127, p = 0.05, ηp^2 = 0.04. Unlike Pillai's Trace, Hotelling's Trace, and Wilks' Lambda that pool their statistics across all discriminant functions, Roy's λ_L uses only the first discriminant function (i.e., the largest eigenvalue) (Hair et al., 2010, p. 369; Tabachnick & Fidell, 2013, p. 271). As such it is the function that maximally discriminates between groups and is considered to represent the upper bound on the F statistic and lower bound of significance (Field, 2013). Given the p-value just at the threshold of 0.05 level of Roy's λ_L it was important to examine group differences with robust confidence intervals, discussed below. Considering the importance of the homoscedasticity assumption for Roy's λ_L (Pituch & Stevens, 2016, p. 210), the use of robust post-hoc tests for Attitude and Knowledge subscales was also advisable due to suspect equality of covariance matrices. While Box's M was nonsignificant for Actions subscales, it was at p = 0.006 for Attitudes and at p = 0.007 for Knowledge subscales. Although still higher than the recommended cut-off at 0.001 for Box's M with large samples (Tabachnick & Fidell, 2013; p. 254), homogeneity of covariance matrices for Attitudes and Knowledge subscales was questionable. The Games-Howell post-hoc test was performed as it is designed for unequal variances and unequal sample sizes (Field, 2013), and controls for familywise error. As with previous analyses bias-corrected bootstrapped 95% confidence intervals were calculated to account for possible violations of normality or influence of outliers.

The Games-Howell post-hoc tests for Attitudes (ATT) subscales were performed along with Tukey HSD and Hochberg's GT2, with no differences in results among the three tests, therefore only Games-Howell results are reported. Bias-corrected bootstrapped confidence intervals were

produced for each pairwise comparison. The faculty in the workshop/course group had significantly higher means on the Accommodations (ATT_ACC) and Inclusive Classroom (ATT_IC) subscales than the faculty who did not have prior disability-related training ($p = 0.015$, [0.046, 0.276]; $p = 0.013$, [0.051, 0.284]). The workshop/course group was also significantly higher on the Course Modifications (ATT_CM) subscale than those who had other types of training in the past ($p = 0.026$, [0.076, 0.528]). Upon examination of the remaining bootstrapped confidence intervals for ATT_CM; the workshop/course group was also significantly higher than the group with no training, based on the bootstrapped confidence interval [0.008, 0.333] while the p-value derived from the non-bootstrapped confidence intervals was not significant.

Since equality of covariance matrices was satisfied for Actions (ACT) subscales, Hochberg's post-hoc test was performed, along with bootstrapped confidence intervals. The faculty who had disability-related workshops/courses in the past had significantly higher means than faculty who had no prior disability-related training, on Accommodations (ACT_ACC; $p = 0.005$, [0.130, 0.490]), Inclusive Classroom (ACT_IC; $p = 0.003$, [0.096, 0.390]), and Inclusive Assessment (ACT_IA; $p = 0.019$, [0.077, 0.430]).

Lastly, for Knowledge subscales the Games-Howell post-hoc test was again used due to suspect equality of covariance matrices. The faculty who received no disability-related training in the past scored significantly lower on the Disability Law and Concepts (DLC) subscale, than faculty who had workshops/courses ($p < 0.001$, [-0.518, -0.273]) and those who had other types of training ($p = 0.001$, [-0.554, -0.149]). No significant differences between types of training were found on the Campus Resources (CR) subscale; this is not surprising since this subscale consists

of questions that ask about familiarity with the disability services office and other student services, which are very visible in the Carleton University community.

In the second series of MANOVA analyses with the independent variable Hours of Disability Training (HDT), results were significant on the multivariate combination of Attitudes subscales, V= 0.072, F(12, 614) = 1.910, p = 0.03, ηp^2 = 0.04, Actions subscales, V= 0.111, F(12, 614) = 3.01, p = 0.001, ηp^2 = 0.06, and Knowledge subscales, V= 0.16, F(4, 622) = 13.494, p = 0.001, ηp^2 = 0.08. As was the case in the first series of multivariate analyses, here again the equality of covariance matrices was satisfied for Actions subscales (Box's M, p = 0.259), but was questionable for Attitudes subscales (Box's M, p = 0.002) and Knowledge subscales (Box's M, p = 0.004). Therefore, robust post-hoc tests were performed for Attitudes and Knowledge subscales. As before, bias-corrected bootstrapped 95% confidence intervals were calculated for all analyses.

The Games-Howell post-hoc test for Attitudes (ATT) subscales was performed along with Tukey HSD and Hochberg's GT2, with no differences in results among the three tests, therefore only Games-Howell results are reported. Faculty who had more than three hours of disability-related training in the past had significantly higher means than faculty who did not have any disability related training, on Accommodations (ATT_ACC; p = 0.002, [0.095, 0.347]) and Inclusive Classroom (ATT_IC; p < 0.001, [0.155, 0.413]), and were also higher than faculty who received up to 3 hours of training on ATT_IC (p = 0.001, [0.121, 0.378]). Once again, the bias-corrected bootstrapped 95% confidence intervals revealed significant results that were not detected with non-bootstrapped confidence intervals, presumably due to the departures from normality and

outliers. Based on bootstrapped confidence intervals, in addition to the above findings, the faculty with more than three hours of training had significantly higher means than faculty with up to three hours of training on ATT_ACC [0.028, 0.257], as well as scoring higher than faculty with no training on Accessible Course Materials (ATT_ACM; [0.005, 0.324]) and on Inclusive Assessment (ATT_IA; [0.023, 0.383]).

For Actions (ACT) subscales, with equal covariance matrices, Hochberg's post-hoc pairwise comparisons showed that faculty with more than three hours of training had significantly higher means than faculty with no training on the Accommodations (ACT_ACC) subscale ($p = 0.001$, [0.191, 0.626]). The bootstrapped confidence interval also revealed significance on the same scale compared to faculty with up to 3 hours of training [0.071, 0.472]. Faculty with more than 3 hours of training reported significantly higher use of inclusive teaching practices on the Inclusive Classroom (ACT_IC) subscale compared to both faculty with up to three hours of training ($p < 0.001$, [0.0234, 0.562]) and no training ($p < 0.001$, [0.286, 0.604]). Faculty with more than three hours of training had significantly higher means than faculty with no training on ACT_IA ($p = 0.005$, [0.132, 0.534]). For the same scale, the bias-corrected bootstrapped 95% confidence interval again revealed a significant difference in favour of faculty with more than three hours compared to faculty with up to three hours of training [0.024, 0.483], which was not detected with the p-value based on the non-bootstrapped confidence interval.

Games-Howell post-hoc test was again used for Knowledge subscales due to suspect equality of covariance matrices, and it indicated that faculty with more than three hours of training had significantly higher means on the Disability Law and Concepts (DLC) subscale compared to

both faculty who had up to three hours of training ($p < 0.001$, [0.224, 0.520]) and faculty who had no training ($p < 0.001$, [0.452, 0.753]). As was the case with type of disability-related training, here again there were no differences across the levels of hours of disability-related training on the Campus Resources (CR) subscale.

Research question 4. Is there a relationship between disability-related training and general pedagogical training, and faculty attitudes and practices in inclusive instruction?

In addition to disability-related training, the following analyses investigated the relationship between general pedagogical training and ITSI Attitudes and Actions subscales. Furthermore, a regression model was constructed to separate the effect of general versus disability-related training in the relationship with Attitudes and Actions subscales. First, two multivariate analyses of variance (MANOVA) were performed to determine if there were differences at the overall level of Attitudes and Actions, as well as individual subscales, based on whether faculty received general pedagogical training in the past (Table 23). In MANOVA (1), the dependent variables were the six ITSI Attitudes subscales, while in MANOVA (2) the dependent variables were the six ITSI Actions subscales. As with previous MANOVA analyses, the reference significance test was Pillai's Trace (V) due to its demonstrated robustness to violations of the normality assumption and outliers (Field et al., 2012; Finch & French, 2013). However, because of its sensitivity to heterogeneity of covariance matrices, robust MANOVA analyses were also performed when homoscedasticity was questionable. Again as with previous multivariate analyses involving a single factor with two levels, a significant MANOVA was followed up with univariate analyses adjusted for multiple comparisons, and where necessary robust alternatives.

As well, discriminant analyses were performed for a more nuanced interpretation under a multivariate model with the use of composite functions (see Research Question 1 for a more detailed discussion of discriminant function as a follow up to MANOVA). And as was done earlier, all analyses were performed with and without suspected outlier cases, and where appropriate any differences in results are reported. The reported effect size measure is partial eta-squared (ηp^2), the default in the MANOVA procedures in SPSS.

Table 23

Factor Levels for General Pedagogical Training in MANOVA (1) and (2)

Factor	Levels	N
General Pedagogical Training	No	98
	Yes	216

MANOVA (1) identified significant differences in the multivariate combination of the Attitudes (ATT) subscales based on general pedagogical training, with $V = 0.084$, $F(6, 307) = 4.71$, $p = 0.001$, $\eta p^2 = 0.08$. Box's *M* test for homogeneity of covariance matrices had the p-value of 0.013, above the suggested cut-off p-value of 0.001 in large samples (Tabachnick & Fidell, 2013; p. 254). However, since the group sizes were not equal, there was a greater concern over the risk of heterogeneous covariance matrices. Hence, robust MANOVA and univariate tests were run. A multivariate one-way rank-based ANOVA confirmed multivariate significance for Attitudes subscales across the factor of general pedagogical training, with $F = 9.298$, $p < 0.001$ (*mulrank* procedure in R; Field et al., 2012, 16.7 section; Wilcox, 2012, p. 431). In addition, two types of robust univariate analyses were performed, the Brown-Forsythe F* and Welch's *W* (Maxwell & Delaney, 2004, p. 113, 131). Both were significant for Accessible Course Materials (ATT_ACM;

p = 0.026), Inclusive Lecture Strategies (ATT_ILS; p = 0.002), Inclusive Classroom (ATT_IC; p = 0.001), and Inclusive Assessment (ATT_IA; p = 0.001). To correct for multiple tests, Bonferroni adjusted pairwise comparisons were also performed confirming significantly higher means for faculty who had general pedagogical training in the past, on ATT_ACM (p = 0.026), ATT_ILS (p = 0.001), ATT_IC (p = 0.001), and ATT_IA (p = 0.001). Since univariate tests do not account for correlations among ITSI subscales, discriminant analysis was performed to determine which linear combination of Attitudes subscales best discriminates among those who did or did not have general pedagogical training (Table 24). Based on standardized discriminant function coefficients with an absolute value larger than 0.3 (Pituch & Stevens, 2016, p. 395 & p. 402), it was evident that ATT_ILS, ATT_IC, and ATT_IA together contributed the most with a positive relationship, while the Accommodations (ATT_ACC) subscale also contributed substantially but with a negative relationship to the discriminant function. Examination of the group centroids (vectors of means), positive for Yes (0.204) and negative for No (-0.449), suggested that faculty who had received general pedagogical training tended to score higher on average on the composite function made up of ATT_ILS, ATT_IC, and ATT_IA, compared to faculty without general pedagogical training. Of note was the difference in the findings from univariate comparisons where ATT_ACM was also significant, demonstrating the value of discriminant analysis as a multivariate procedure that is more precise in locating differences when compared to univariate analyses. What was also evident was the known sensitivity of discriminant analysis to outliers – when the three suspected outlier cases were removed the function changed in that ATT_ACM crossed 0.3 while the contribution of ATT_ILS was lowered. Lastly, a very interesting issue was the substantial negative contribution of ATT_ACC on the discriminant function which suggested something other than the Yes response on the three

subscales with positive contributions accounted for the negative contribution of ATT_ACC. Since the grouping variable (general pedagogical training) had only two levels, Yes and No, the single function consequently identified the other alternative, the No answer. In other words, those who did not receive general pedagogical training tended to score higher on ATT_ACC. Aside from this conclusion not being very intuitive, its unexpected result suggested that something other than general pedagogical training must account for a strong contribution of ATT_ACC to the discriminant function. This intriguing finding was further explored in the hierarchical regression analyses described below.

Table 24

Standardized Discriminant Function Coefficients for ITSI Attitude Subscales on General Pedagogical Training

ITSI Attitudes subscales	Function 1
Accommodations (ACC)	-.444
Accessible Course Materials (ACM)	.180
Course Modifications (CM)	-.038
Inclusive Lecture Strategies (ILS)	.362
Inclusive Classroom (IC)	.464
Inclusive Assessment (IA)	.544

MANOVA (2) identified significant differences in the multivariate combination of the Actions (ACT) subscales based on general pedagogical training, with V= 0.087, F(6, 307) = 4.89, p = 0.001, ηp^2 = 0.09. Homogeneity of covariance matrices was satisfied at p-value of 0.377. Bonferroni adjusted pairwise comparisons showed significantly higher means for faculty who had general pedagogical training in the past, on Accessible Course Materials (ACT_ACM; p =

0.004), Inclusive Lecture Strategies (ACT_ILS; p = 0.012), Inclusive Classroom (ACT_IC; p = 0.001), and Inclusive Assessment (ACT_IA; p = 0.001). Discriminant analysis for Actions subscales identified a function very similar to the function for Attitudes subscales without outliers. Strong positive contributions based on standardized discriminant function coefficients with an absolute value larger than 0.3 were made by ACT_ACM, ACT_IC, and ACT_IA, while ACT_ACC had a strong negative contribution. So again, it was evident that the Accommodations (ACC) subscale on both Attitudes and Actions dimensions suggested strong association with a linear multivariate combination within each of the two dimensions based on something other than general pedagogical training.

The results from separate multivariate analyses on disability-related and general pedagogical training identified significant group differences for both of those factors. To examine the relationship between disability-related and general pedagogical training, the two were evaluated as predictors in a hierarchical multiple regression model. General training was entered first, and disability-related training second to determine its effect on each of the selected ITSI subscales, separate from the effect of general pedagogical training. This order of predictors was based on the assumption that in faculty development general pedagogical training is more common than disability-related training, as well as interest in determining if and to what extent disability related training adds value in addition to value contributed by general pedagogical training. The ITSI subscales included in the regression analyses as response variables were those for which there were significant effects of both disability-related training and general pedagogical training in the previous analyses, leading to the interest in partialing out the effects of each training. The exceptions were the two Accommodations (ACC) subscales for which the mean comparison

analyses were not significant on general pedagogical training; however, as mentioned above discriminant analyses revealed a substantial negative contribution of ACC to the discriminant functions based on general pedagogical training. For this reason ACC subscales were included in the regression analyses to confirm the suggested findings from the earlier analyses that it is only the disability-related training that influences attitudes and practices in Accommodations (ACC).

It is important to emphasize that regression analyses were used here to examine the *relationship* between the two predictors and their relationship with respect to changes in the response variable. In fact these regression analyses are methodologically equivalent to a one-way ANOVA with general training as a covariate (i.e. ANCOVA), but hierarchical regression analysis allows for more accessible parameter estimation and evaluation of assumptions. In other words, a regression model here was not built as a predictive model as this would require many more predictors to achieve satisfactory levels of R^2 and stability as a predictive model. With only two predictors in a regression model with response variables as conceptually broad as ITSI subscales (e.g. Inclusive Classroom), it was expected that R^2 would be very low. For this reason, the following results report R^2 change values as well as coefficients to examine significance of general versus disability-related training. Since predictive ability and generalizability of the model was not of interest, formal model cross-validation was not pursued. The reliability of the significance of coefficients was important and this was achieved with the use of bias-corrected bootstrapped confidence intervals and standard errors (Tabachnick & Fidell, 2013; p. 143).

Table 26 contains a summary of hierarchical regression analyses for two Attitudes and three Actions subscales. General Pedagogical Training entered at Step 1, and Disability-Related

Training at Step 2, as dichotomous predictors each coded 0 (No) and 1 (Yes). The assumption of independent errors was met for all analyses, confirmed with the Durbin-Watson values between 1.8 and 2. Multicollinearity was not present indicated by the variance inflation factor (VIF) average values of 1. Casewise diagnostics and relevant tests were used to assess model bias due to influential cases. While some subscales had extreme values for standardized residuals just over 3, further examination confirmed no undue influence on the model with Cook's distances between 0 and .5, and centered leverage minimum and maximum values less than twice the average value. Homoscedasticity and linearity were confirmed with examination of plots of standardized residuals against standardized predicted values. Examination of histograms and normal probability plots for standardized residuals revealed slight departures from normality for ATT_ACC, ATT_IC, and ACT_ACC, which was addressed with the use of bootstrapping for coefficient significance testing.

Table 25

ITSI Subscales with R^2 Change and Bootstrapped Standardized Beta Coefficients

	ATT_ACC		ATT_IC		ACT_ACC		ACT_IC		ACT_IA	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1: General Pedagogical Training	0	.03	.05†	.22†	0	.01	.04†	.21†	.05†	.22†
Step 2: Disability-Related Training	.02†	.14†	.02*	.13*	.02†	.16†	.03†	.16†	.01*	.12*

* $p < .05$. † $p < .01$

Note. β significance based on Bias-corrected (BCa) bootstrapping with 2000 samples.

Hierarchical multiple regression (HMR) analyses for the two Accommodations subscales on Attitudes and Actions, ATT_ACC and ACT_ACC, confirmed earlier findings and showed that

general pedagogical training had no contribution to the variance in the regression equation, while the unique contribution of disability-related training was significant at alpha 0.01 with change statistics of $\Delta R^2 = 0.02$, $F_{(1, 311)} = 6.51$, $p = 0.011$ for ATT_ACC, and $\Delta R^2 = 0.02$, $F_{(1, 311)} = 7.83$, $p = 0.005$ for ACT_ACC. Significant standardized coefficients $\beta = 0.14$ and $\beta = 0.16$ at $p < 0.01$ confirmed disability-related training as a unique predictor of ATT_ACC and ACT_ACC indicating that faculty who had prior disability-related training had higher agreement with attitudes related to accommodations. On the Attitudes subscale of Inclusive Classroom (ATT_IC) both general pedagogical training and disability-related training were unique predictors ($\beta = 0.22$, $p = 0.001$; $\beta = 0.13$, $p = 0.015$), with disability-related training ($\Delta R^2 = 0.02$, $F_{(1, 311)} = 5.63$, $p = 0.018$) contributing significant variance after controlling for general pedagogical training ($\Delta R^2 = 0.05$, $F_{(1, 312)} = 16.8$, $p = 0.001$). The same pattern of results was observed for the Actions subscale of Inclusive Classroom (ACT_IC) where both general and disability-related training were significant predictors at $p < 0.01$ ($\beta = 0.21$; $\beta = 0.16$), with disability-related training again having a unique contribution ($\Delta R^2 = 0.03$, $F_{(1, 311)} = 8.61$, $p = 0.004$), over and above the significant contribution by general pedagogical training ($\Delta R^2 = 0.04$, $F_{(1, 312)} = 14.5$, $p = 0.001$). Disability-related training also contributed very small but unique variance with $\Delta R^2 = 0.01$, $F_{(1, 311)} = 4.75$, $p = 0.03$ on the Actions subscale of Inclusive Assessment (ACT_IA) and was a significant predictor ($\beta = 0.12$, $p = 0.03$) in the HMR equation after controlling for the significant effect of general pedagogical training ($\Delta R^2 = 0.05$, $F_{(1, 312)} = 16.1$, $p = 0.001$). The results on ATT_IC, ACT_IC, and ACT_IA indicate that while general pedagogical training has a significant influence on these aspects of inclusive instruction, disability-related training on its own has a significant effect over and above that due to general pedagogical training.

Research question 5. How effective is a one-time disability-related faculty development workshop in changing faculty attitudes and knowledge in inclusive instruction?

The analyses of disability-related training suggested workshops or courses have a more significant impact on faculty attitudes, practices, and knowledge with regards to inclusive teaching practices compared to no training or other types of training. It was also evident that faculty who had more than three hours of training showed higher endorsement of such attitudes, practices, and knowledge. As mentioned in the Methods section, in the present research project another sample was collected whose analysis may shed further light on the effects of a one-time workshop as a type of disability-related faculty development in inclusive instruction and accessibility in teaching and learning. The data in this sample were collected by administering the ITSI survey just before and immediately after one of six presentations of the 2.5-hour AODA Accessible Learning workshop at Carleton University. The pre-post data were analysed for each of the six Attitude subscales and two Knowledge subscales. Actions subscales were not included in the analysis as they measure reported implementation of inclusive teaching practices, which would not be applicable since the pre and the post surveys were administered prior to and following each Accessible Learning workshop with no opportunity to measure the subsequent implementation.

Unlike the main sample, due to the small size of the Accessible Learning workshop sample – the Workshop sample hereafter – a multivariate analysis of subscale data was not feasible. More so, from a theoretical perspective overall effectiveness would not be as informative, and the effect of the workshop on specific subscales would need to be examined even if omnibus testing were

possible. Therefore, for the Attitudes dimension, six separate paired sample t-tests were performed for each subscale. Although the paired t-test has the advantage of using the entire sample for each analysis to maximize power, the 21 participant sample was still relatively small with modest power, 0.6 for alpha of 0.05 with moderate effect size of 0.5 (Cohen, 1988; Faul, Erdfelder, Lang, & Buchner, 2007). Interpretation of the results takes into consideration the estimated power for the given sample size, alpha, and effect size.

With regards to multiple t-tests, the issue of familywise error rate (FWER) was considered (Maxwell & Delaney, 2004, p. 194). FWER is based on the assumption of the universal null hypothesis (Tukey, 1980, as cited in Tutzauer, 2003), where a Type I error on any hypothesis within a group of hypotheses (family) results in the rejection of the universal null hypothesis. This was a concern for the omnibus MANOVA analyses because of the interest in declaring significance at the level of the overall dimensions of Attitudes and Actions. However, for the present analysis, overall significance was not of interest – rather, I wished to know what impact the Accessible Learning workshop had on each ITSI subscale, each representing conceptually distinct areas of inclusive instruction. Therefore, the notion of FWER was not applicable in this case because a Type I error on any one ITSI subscale would have no bearing on the interpretation of inference for other ITSI subscales. More applicable in this context would be the false discovery rate (FDR), a ratio of Type I errors within a collection of hypotheses (Benjamini & Hochberg, 1995, 2000), specifically related to dependent test statistics such as the paired t-test used here (Benjamini & Yekutieli, 2001) – as such, FDR was addressed in the present analyses. A further issue with respect to corrections for multiple testing was the already modest power due to the small sample size. Corrections to alpha levels lead to reduction in power, most severely

with the traditional Bonferroni correction, but also with more adaptive p-value adjustments. With the small size of the Workshop sample, further reduction in power would significantly limit the ability to detect effects where they in fact existed. Lastly, the entire issue of correcting for FWER or FDR was taken with great reservation from the perspective of generating research within the nascent research area of inclusive instruction. In contrast to their acknowledged importance from a purely statistical standpoint, such corrections have been viewed as an overly restrictive, even misdirected, approach to protection against false findings within a field of research. Arguments have been made that statistical corrections for FWER stifle generation of data needed for replication as the gold standard in research, and have led to calls to abandon such methods from writers in applied research (Brandt, 2007; O'Keefe, 2003; Nakagawa, 2004; Perneger, 1998).

Reflecting the above considerations, the results of the paired sample t-tests are reported with unadjusted p-values, along with p-values adjusted for FWER and FDR with several different procedures.[6] In addition, results are presented for the three sets of Workshop sample data treated for missing values as discussed in the section Missing Data - listwise deletion (LISTWISE), expectation-maximization (EM), and multiple imputation (MI). Cohen's *d* effect sizes are reported for each paired test, corrected for within-subject dependence of means in paired t-tests with the method by Morris and DeShon (2002). Table 26 with p-values shows that there was a significant difference in means in the MI data, increasing from pre to post surveys on the subscales of ATT_ACC (M_D = -0.21, $t_{(20)}$ = -2.70, d = 0.607), ATT_IC (M_D = -0.12, $t_{(20)}$ = -2.06, d = 0.464), and ATT_IA (M_D = -0.19, $t_{(20)}$ = -2.16, d = 0.492). A range of p-value adjustment procedures are also reported (*multtest* package in R, Pollard, Dudoit, & van der Laan, 2005). Bonferroni, Holm, and Hochberg procedures are focused on controlling FWER, while the

[6] *p* values are reported in the tables, but not in-text due to the number of adjusted *p* values for each variable.

Benjamini-Hochberg (BH) and Benjamini-Yekutieli (BY) procedures focus on the control of FDR. It is evident that all of the correcting procedures result in power reduction, leaving only ATT_ACC significant in the MI data. In the EM data with bias-corrected bootstrapped confidence intervals and standard errors, the means on post-workshop surveys were significantly higher for four subscales (Table 27), ATT_ACC (M_D = -0.23, $t_{(20)}$ = -3.22, d = 0.704), ATT_ACM (M_D = -0.15, $t_{(20)}$ = -2.37, d = 0.501), ATT_IC M_D = -0.14, $t_{(20)}$ = -2.67, d = 0.581), and ATT_IA (M_D = -0.20, $t_{(20)}$ = -2.68, d = 0.577). In addition to the p-value correction procedures used for the MI pooled statistics, the EM single-imputed dataset allowed use of permutations for empirical adjustment of p-values based on ranking of the paired t statistic against a simulated sampling distribution under the null hypothesis (step-down maxT procedure, Westfall & Young, 1993). The majority of correction procedures again only retained significance for ATT_ACC, except for BH and maxT which also detected an effect in ATT_IC and ATT_IA. Of note is the marginal significance under maxT permutation procedure for ATT_IC and ATT_IA, which is nevertheless accepted considering the influence of the small sample size on power. Lastly, data treated with listwise deletion showed significant results with bias-corrected bootstrapping for the same set of subscales as EM data (Table 28), ATT_ACC (M_D = -0.21, $t_{(17)}$ = -2.82, d = 0.660), ATT_ACM (M_D = -0.18, $t_{(17)}$ = -2.66, d = 0.614), ATT_IC (M_D = -0.16, $t_{(17)}$ = -3.09, d = 0.699), and ATT_IA (M_D = -0.22, $t_{(17)}$ = -2.56, d = 0.587). As was the case with the EM data, here again BH and maxT procedures retained the most power, detecting effects comparable to unadjusted p-values on the four subscales.

Table 26

Adjusted p-Values for Paired t-Tests with Effect Sizes on ATT Subscales with MI Data

Pre-Post ITSI Subscales	Raw *p*	Bonferroni	Holm	Hochberg	Sidak	BH	BY	Cohen's *d*
Accommodations (ACC)	0.007*	0.042*	0.042*	0.042*	0.041*	0.042*	0.103	0.607
Accessible Course Materials (ACM)	0.101	0.606	0.303	0.303	0.273	0.152	0.371	0.369
Course Modifications (CM)	0.286	1.000	0.572	0.308	0.490	0.308	0.755	0.238
Inclusive Lecture Strategies (ILS)	0.308	1.000	0.572	0.308	0.490	0.308	0.755	0.232
Inclusive Classroom (IC)	0.040*	0.240	0.160	0.160	0.151	0.080	0.196	0.464
Inclusive Assessment (IA)	0.031*	0.186	0.155	0.155	0.146	0.080	0.196	0.492

* $p < .05$.

Table 27

Adjusted Bootstrapped p-Values for Paired t-Tests with Effect Sizes on ATT Subscales with EM Data

Pre-Post ITSI Subscales	Raw *p*	Bonferroni	Holm	Hochberg	Sidak	BH	BY	maxT	Cohen's *d*
Accommodations (ACC)	0.007*	0.042*	0.042*	0.042*	0.041*	0.040*	0.098	0.024*	0.704
Accessible Course Materials (ACM)	0.038*	0.228	0.114	0.114	0.110	0.057	0.140	0.066	0.501
Course Modifications (CM)	0.284	1.000	0.284	0.284	0.284	0.284	0.696	0.259	0.234
Inclusive Lecture Strategies (ILS)	0.124	0.744	0.248	0.248	0.233	0.149	0.365	0.222	0.341
Inclusive Classroom (IC)	0.019*	0.114	0.095	0.080	0.091	0.040*	0.098	0.054*	0.581
Inclusive Assessment (IA)	0.020*	0.120	0.095	0.080	0.091	0.040*	0.098	0.054*	0.577

* $p < .05$.

Table 28

Adjusted Bootstrapped p-Values for Paired t-Tests with Effect Sizes on ATT Subscales with Listwise Data

Pre-Post ITSI Subscales	Raw *p*	Bonferroni	Holm	Hochberg	Sidak	BH	BY	maxT	Cohen's *d*
Accommodations (ACC)	0.014*	0.084	0.070	0.070	0.068	0.042*	0.103	0.042*	0.660
Accessible Course Materials (ACM)	0.031*	0.186	0.104	0.093	0.100	0.047*	0.114	0.047*	0.614
Course Modifications (CM)	0.255	1.000	0.292	0.255	0.271	0.255	0.625	0.249	0.274
Inclusive Lecture Strategies (ILS)	0.146	0.876	0.292	0.255	0.271	0.175	0.429	0.249	0.359
Inclusive Classroom (IC)	0.009*	0.054	0.054	0.054	0.053	0.042*	0.103	0.041*	0.699
Inclusive Assessment (IA)	0.026*	0.156	0.104	0.093	0.100	0.047*	0.114	0.049*	0.587

* $p < .05$.

An additional paired t-test was performed for one of the Knowledge subscales, specifically DLC, while the other Knowledge subscale CR was left out of the analysis due to a survey design error that resulted in the questions contributing to the CR subscale being skipped. There was a significant mean difference with bias-corrected bootstrapping on DLC with higher scores on the post-workshop survey ($M_D = -0.91$, $t_{(20)} = -7.01$, $p < 0.001$, $d = 1.50$) in the EM imputed data set, with the same *p* value in the data sets treated with MI and listwise deletion. Overall, the results of the paired t-tests suggested the Accessible Learning workshop was effective short-term in promoting attitudes toward accommodations, accessible course materials, inclusive classroom practices, and flexible methods of assessment, as well as knowledge related to disability laws and concepts.

CHAPTER IV

DISCUSSION

The research problem statements outlined a number of issues with the current state of research in postsecondary inclusive educational practices, specifically universal design models, and the related faculty development. Those issues inspired the five research questions and the research design intended to answer them. I evaluated the present attitudes and practices of Carleton University faculty and instructors with regard to inclusive instruction and in relation to faculty development. The discussion in this chapter is organized according to the five research questions with implications to our understanding of the relationships between attitudes and practices, and their relationship with both general and disability-related faculty development. In addition to discussing the findings specific to the individual focus of each research question, common to all research questions were two overarching goals: a) to contribute further research data on the ITSI instrument as one of the very few validated measures of inclusive instruction and the concept of universal design in teaching and learning; and b) to demonstrate the use of certain advanced statistical methods, seldom utilized in education research, to analyze data in the context of familiar research topics such as faculty attitudes, knowledge, practices, and pedagogical development.

In this concluding chapter I will summarize the results of the analyses for each research question in non-technical terms, and will discuss them in relation to:

- the past research findings as reported in the Literature Review,
- the implications for faculty development both general and disability related,
- the concepts of inclusive instruction and universal design, and in contrast to disability-related accommodation services,
- the Inclusive Teaching Strategies Inventory (ITSI) as a measure of inclusive instructional attitudes and practices,
- methodological contributions and insights for educational research in general,
- the postsecondary disability legal landscape in Ontario, specifically the AODA requirement for educator training, and
- the institutional context of Carleton University and relevant recommendations.

The chapter will conclude with the discussion of the limitations and contribution of the present research project, and practical recommendations for faculty development in inclusive instruction.

Research Findings

Research question 1. *What are the characteristics of faculty attitudes and practices with regards to inclusive instruction?*

The analysis of the ITSI survey results from the main sample of 314 faculty and instructors in this research question focused on general characteristics of faculty attitudes and practices toward inclusive instruction and group differences on select demographics. On average, faculty have positive attitudes toward accommodating students with disabilities and the select areas of inclusive instruction, specifically those related to making course materials more accessible through use of technology, lecture strategies that promote processing of information, and incorporating variability and flexibility in the course design. They are not as strongly but

still somewhat supportive of statements that endorse flexibility in assessment methods and deadlines. In contrast, on average faculty are somewhat opposed to extra credit assignments or reducing course work for students with or without disabilities. It is noticeable in these findings that positive attitudes wane once faculty are considering strategies that can be perceived as modifying the requirements of the course. This may be partly a reflection of the policy context at Carleton University and the related beliefs, where it is established through the University Accommodations Policy that disability-related accommodations must not undermine essential course requirements.

The reported practices appear to be in line with attitudes, such that faculty usually implement practices related to accommodations, accessible course materials, inclusive classroom environments and lecture strategies, as well as flexibility in assessments. Also in line with the attitudes, the practices related to modification of course requirements were on average reported as never being implemented, indicating strong opposition to modifications such as reducing course work or giving grade raising assignments. A formal evaluation of the alignment between attitudes and practices was performed as part of Research Question 2, and is discussed in the section that follows.

These findings on general characteristics of faculty attitudes and practices demonstrate the value of ITSI in helping us gain a more nuanced understanding of faculty attitudes toward inclusive instruction. Past research has confirmed that faculty have positive attitudes toward students with disabilities and accommodations, as well as endorsing the ideas behind universal design. Not only are past findings general in scope but it is typically not clear if there is differentiation

between attitudes and practices related to provision of disability-related accommodation versus those related to inclusive instruction or universal design. While disability-related accommodations are acknowledged by universal design models, there is a clear conceptual juxtaposition of the two. Academic accommodations are a traditional, retroactive approach to supporting postsecondary students with disabilities founded in the medical tradition of disability, while accessibility, universal design, and inclusive instruction are premised on proactive design of learning environments to reduce learning barriers and in the process the need for accommodations. ITSI contains the Accommodations subscale, which is distinct and makes a large contribution to the instrument. However, the rest of the instrument is made up of subscales that have been derived through factor analyses from the pool of questions related to universal design, accessibility of learning environments, and inclusive instruction. It is useful to be able to separate attitudes toward accommodations from attitudes related to inclusive instructional practices, something that past research had not done. At the same time it is acknowledged that the original factor analysis confirmed "inherent overlap between accommodating students and adopting the principles of Universal Design" (Lombardi, 2010, p. 74). The findings from Research Question 1 confirm previous findings regarding attitudes and practices related to accommodating students with disabilities, but additionally reveal endorsement of some attitudes toward inclusive instruction with less support for those related to flexibility of assessments and clear opposition to course modifications.

There are implications for faculty development informed by the group comparisons on select demographic categories: gender, faculty rank and affiliation, and experience working with students with disabilities. In contrast to previous research as reported in the Literature Review,

gender was not found to be a significant factor in the group analyses with no differences between male and female faculty on Attitudes and Actions subscales. However, this is in line with the research by Lombardi (2010), the author of the ITSI, who also found no gender differences. It is an encouraging finding because it is difficult to meaningfully interpret why gender would influence faculty attitudes or practices toward inclusive instruction to support postsecondary students with disabilities. It would be even more difficult and problematic to draw conclusion regarding implications for faculty development in this area on the basis of gender alone. The past findings were related to female faculty being more willing to accommodate and had more confidence in their knowledge about disabilities, within the context of supporting students with academic accommodations. Perhaps this again illustrates the different understanding we can gain about higher education faculty and issues of disability once the research lens is no longer restricted to provision of accommodations, as was typically the case in past research, but is refocused on several other areas related to inclusive instruction.

The comparison based on faculty rank confirmed past findings that non-tenured faculty were more supportive of accommodating students with disabilities than tenured faculty. The present research shows this difference goes beyond accommodations with non-tenured faculty having significantly higher endorsement of attitudes toward several areas of inclusive instruction, such as course modifications, inclusive lecture strategies, inclusive classroom, and inclusive assessment. Since there is overlap among these areas, discriminant analyses were used to determine which of these areas contributed most to the differentiation between non-tenured and tenured faculty on attitudes and practices in inclusive instruction. It was revealed that the subscale of Inclusive Classroom had the highest contribution both within attitudes and practices.

The Inclusive Classroom subscale consists of items related to incorporating a variety of instructional modalities, supplementing in-class work with technology and aids, and making course materials available in a variety of formats. These are the aspects of teaching and learning in which non-tenured faculty differed the most from tenured faculty with respect to attitudes and practices. The Inclusive Classroom subscale also includes statements about inviting students with disabilities to approach the instructors for supports and generally creating a welcoming environment for students with disabilities. These findings suggest the need for increased focus on faculty development activities in inclusive instruction for tenured faculty. Such a recommendation has implications that extend beyond the domain of teaching and learning services and requires wider institutional support to develop engagement strategies specific to tenured faculty.

Differences in attitudes and practices toward inclusive instruction according to faculty affiliation provide further guidance for strategic implementation of faculty development activities at institutions of higher education such as Carleton University. Members of the Faculty of Arts and Social Sciences show significantly more positive attitudes toward inclusive instructional practices than the faculty from other faculty units. Past research has showed inconsistent findings regarding the differences in faculty units, although faculty from social sciences and education were commonly reported as being more supportive of issues of accommodation for students with disabilities. The results from the present study confirm that faculty members from Arts and Social Sciences are an important source of knowledge, expertise, and experience to be relied on in our efforts to promote inclusive instructional practices through faculty outreach and development activities. Comparing other Faculties to the Faculty of Arts and Social Sciences

may be questioned as an appropriate reference criterion. One argument that can be anticipated is that the Faculty of Arts and Social Sciences is an extreme reference point, perhaps due to its inclusion of disciplines that promote understanding and support of individual and social issues. Alternatively, such an argument reinforces the need for faculty development activities in other Faculties to promote the same kind of understanding and practices seen among educators from Arts and Social Sciences. Also, it is evident from simple examination of means that participants from the Faculty of Arts and Social Sciences responded in a similar pattern as the participants from other faculties. As discussed earlier in this section, average endorsement of Attitudes and Actions was fairly consistent among the participants, and this is true when the Faculties were compared as well. Lastly, the differences among the Faculties were not only due to comparisons with the Faculty of Arts and Social Sciences. For example, the Faculties of Science and Engineering show lower degree of endorsement of Attitudes and Actions not just in comparison to the Faculty of Arts and Social Sciences but in comparison to other Faculties as well. Specifically, the participants from the Faculties of Science and Engineering scored lower in areas of accommodations compared to the Faculties of Business and Public Affairs, and accessible course materials compared to the Faculty of Business, in addition to scoring lower than the Faculty of Arts and Social Sciences on a number of Attitudes and Actions subscales (accommodations, inclusive classroom, inclusive assessment). These results, consistent with related findings from past research, strongly suggest the need for faculty development in inclusive instruction to be provided to the faculty members and instructors in Science and Engineering. Among the faculty from Public Affairs, in addition to having a significantly lower average on subscales of accommodations and inclusive classroom than the Faculty of Arts and Social Sciences, an interesting finding emerged on the course modifications subscale. The

tenured faculty in Public Affairs reported modifying course requirements in practice more often than faculty from Arts and Social Sciences, Science, and Engineering to accommodate students with disabilities but also other students, in keeping with the principles of universal design. However, the reverse was the case for non-tenured faculty in Public Affairs, who scored lower on the same Actions subscale compared to the faculty from Arts and Social Sciences. As mentioned previously, the course modification subscale was the only one on which participants overall showed opposing attitudes and little use in practice. For faculty development purposes, this suggests that tenured faculty from Public Affairs may be able to provide valuable insight into the use of course modifications as a strategy for inclusive instruction and address the concerns over undermining essential requirements that may be held in other Faculties. Finally, Business faculty report a higher level of agreement than all other Faculties with attitudes related to accessible course materials, which include use of online resources to post materials and allow submission of assignments, although their reported practices on the same subscale were not significantly higher compared to other Faculties.

This study contributed a more nuanced understanding of the effect of disability experience on pedagogical attitudes and practices by separating the factors of personal experience (e.g. having disability oneself) from the experience teaching student with disabilities. While personal experience was not a significant group factor in Attitudes and Actions, there were significant differences based on the number of students with disabilities taught in the past. As mentioned previously, the course modifications subscale was the only subscale on which participants showed clearly low endorsement and lack of implementation of strategies that incorporate extra credit assignments or reduce course work for students with or without disabilities. Interestingly,

on this subscale faculty who worked with 1-5 students in the past showed significantly higher levels of agreement with such practices than faculty who worked with larger numbers of students with disabilities. This suggests that one of the reasons for low endorsement of the course modifications strategies may simply be the complexity and workload in implementing course modifications when there are a large number of students with disabilities. It would be worthwhile exploring this further to solicit qualitative feedback on the reasons for opposition to course modifications as a strategy for inclusive instruction. Other than the course modifications subscale, faculty who taught higher numbers of students with disabilities show significantly higher endorsement of certain attitudes and practices. For example, having taught 1-5 students with disabilities in the past is associated with positive attitudes toward accommodating students with disabilities compared to faculty who never taught any students with disabilities. Also, faculty who taught more than 20 students with disabilities in the past more often implemented accommodation supports compared to both those who taught 1-5 students with disabilities in the past, and inclusive classroom strategies compared to those who never taught any students with disabilities in the past.

Research question 2. *Are there discrepancies between faculty attitudes and practices in inclusive instruction?*

Past research has suggested that faculty endorse principles of universal design but report low levels of implementation of the related practices; however, in some studies this kind of relationship between attitudes and practices was not present and some findings showed a less intuitive relationship of higher actions and lower associated attitudes. The findings in the present study were more consistent and easier to interpret. Across all subscales there was a significant

pattern in the relationship between Attitudes and Actions. The proportion of faculty with positive attitudes and frequent practices on the same subscale was found to be significantly higher than would be expected if there were no relationship between attitudes and practices. Similarly the proportions of a negative response on both Attitudes and Actions for each subscale were significantly higher than expected under the null hypothesis of independence of proportions. These findings show that when faculty responded to a subscale, the proportions of positive responses and the proportions of negative responses were consistent between attitudes and practices for that subscale. Unlike the previously studied samples of postsecondary faculty with respect to inclusive instruction, Carleton University faculty appear to 'practice what they preach.' Considering the discrepancy between endorsement of principles and implementation of practices has been recorded in the literature as one of the major shortcomings of universal design in higher education, it seems worthwhile to further investigate what factors contribute to the consistency of attitudes and practices among Carleton University faculty.

Research question 3. *Is there a relationship between disability-related training and faculty attitudes, practices, and knowledge in inclusive instruction?*

One of the main objectives for the present research study was to examine the relationship between disability-related training and the measured aspects of inclusive instruction. This is one of the areas in past research with scarcity of reliable data to inform disability-related faculty development specifically in relation to inclusive instructional practices, accessibility in teaching and learning, or universal design. Examining this relationship was also of interest because of the requirement for educator training in this area established by the Accessibility for Ontarians with

Disabilities Act (AODA) in Ontario and the resulting effort and resources invested in offering relevant faculty training to comply with the requirement.

Faculty who have received disability-related workshops or courses as the form of faculty development show more positive attitudes on subscales of accommodations, inclusive instruction, and course modifications compared to those who did not have any disability-related training in the past, as well as those who received other types of training on the course modifications subscale. Similarly with respect to implementation of practices related to these attitudes, faculty who attended workshops or courses report implementing a higher degree of accommodation supports, multiple ways and opportunities for engagement and interaction within the classroom, and flexibility and variety in the methods of evaluation. Familiarity with disability laws and concepts was also significantly lower for those who had no training compared to faculty who attended workshops, courses, or other forms of training. The findings clearly indicate there is a positive association between disability-related training and attitudes, practices, and knowledge with respect to accommodations, as well as several aspects of inclusive instruction. Furthermore, the results suggest there is an advantage workshops or courses have over other forms of training or no training, which is supportive of the current practices at Carleton University in delivery of disability-related faculty development to meet the AODA requirement for educator training.

The above findings suggest disability-related training is effective in supporting faculty attitudes and practices toward inclusive instruction, and more specifically there are advantages to the workshops and courses as the format of relevant faculty development. The other question of

interest related to this particular series of analyses was the relationship with the length of disability-related training. It is another way of asking whether disability-related training works by examining the relationships between faculty who received no training and faculty who received short or longer training. The results show that faculty with over three hours of training had significantly more positive attitudes than faculty who received no training on majority of ITSI subscales, namely Accommodations, Accessible Course Materials, Inclusive Classroom, and Inclusive Assessment. In addition, faculty with over three hours of training had higher scores than those with up to three hours of training on Accommodations and Inclusive Classroom subscales. Once again, reflecting the value of the present study and the ITSI instrument, it was possible to concurrently assess reported implementation of practices related to attitudes in those areas. In line with the observed consistency between attitudes and practices of Carleton University faculty, as discussed previously under Research Question 2, the findings related to length of training and faculty practices are very similar to their attitudes. Faculty with more than three hours of disability-related training report more commonly implementing practices in the areas of accommodations, inclusive classroom, and inclusive assessment, compared to faculty with no training and faculty who received up to three hours of training. The same pattern was observed with respect to the level of knowledge of disability laws and concepts, with faculty who received more than three hours of training scoring significantly higher than faculty with no training or up to three hours of training. These findings together further confirm that disability-related faculty development influences faculty attitudes and practices in inclusive instruction, and it suggests that longer training is associated with more positive attitudes and practices in inclusive instruction. With respect to the AODA requirement for educator training, these findings suggest that faculty training of short duration is not likely to have an impact on promoting

accessibility awareness as intended. Longer faculty development that is specific to the areas of disabilities, accessibility, and inclusive instructional methods such as universal design are required to influence faculty attitudes and practices.

Research question 4. *Is there a relationship between disability-related training and general pedagogical training, and faculty attitudes and practices in inclusive instruction?*

One of the leading charges made against universal design in areas of learning and instruction is that such models and guidelines are fundamentally about good teaching, i.e., sound pedagogical practices already promoted by established, general faculty development. What is implied in this is that universal design models contribute nothing new to what we already provide in regular faculty development activities as 'best practices' in teaching and learning. The ITSI instrument was developed and validated in part to incorporate the principles of universal design and to provide an overall measure of attitudes and practices with regards to inclusive instruction. In the present study, in addition to the ITSI subscales, questions were asked to collect information about the extent of disability-related training received in the past, as discussed in the section above. The faculty were also asked if they had received general pedagogical training. The analyses in Research Question 4 focused on contrasting disability-related and general pedagogical training, and their relationship with attitudes and practices in inclusive instruction. Indeed it was found that faculty who have received general pedagogical training in the past had significantly higher attitudes and reported practices on a majority of subscales in inclusive instruction, namely Accessible Course Materials, Inclusive Lecture Strategies, Inclusive Classroom, and Inclusive Assessment. It is noted here that general pedagogical training was not related to the Accommodations subscale, an expected finding since provision of accommodations

has traditionally been supported through disability-related faculty development. The discriminant function analysis confirmed that general pedagogical training has no relationship with accommodations, but that it certainly is related to the above four areas of inclusive instruction across both attitudes and actions. This is a significant finding that appears to confirm the beliefs that models of inclusive instruction and universal design are fundamentally about sound pedagogical practices, subject to the influence of general pedagogical training. The question however remained whether disability-related training adds anything above and beyond the influence of general pedagogical training in these areas of inclusive instruction.

First it was evident in previous analyses that disability-related training is strongly associated with accommodation attitudes and practices, while general pedagogical training has no relationship to this specific area. Since academic accommodations have a central place in the support systems for students with disabilities in higher education, it is clear that disability-related faculty development is of key importance. However, universal design and inclusive instruction are premised on designing courses to reduce barriers to learning and making them accessible to students with disabilities, thereby in part reducing the need for accommodations. Historically and conceptually, universal design and accessibility in teaching and learning is an approach that is distinct from the traditional approach of accommodation services as the cornerstone of disability service offices in postsecondary institutions. Therefore, it can be argued that it is expected general pedagogical training would not impact accommodations, but that it would impact the areas more closely related to inclusive instruction and universal design. As reported above, this was confirmed in the present study; that general pedagogical training is related to all but one subscale representing inclusive instruction without the accommodations subscale. However, as

discussed under the previous research question, disability-related training was also significantly related to all but one inclusive instruction subscale, in addition to the accommodations subscale. So the question then was whether this influence of disability-related training is in fact due to the confounding influence of general pedagogical training, since faculty could have been exposed to both. In other words, one of the analyses in this research question investigated if disability-related training was a predictor of attitudes and practices in inclusive instruction over and above the effect of general pedagogical training. Hierarchical regression analyses showed that disability-related training was a unique predictor, while controlling for general pedagogical training, of attitudes and practices related to inclusive classroom and practices related to inclusive assessment. In other words, out of the four subscales on which both disability-related and general pedagogical training significantly impact attitudes and practices, it was shown that disability-related training still retained influence on two of those four subscales in inclusive instruction after the confounding influence of general pedagogical training was controlled for. These findings lead to the conclusion that in order to promote attitudes and practices in inclusive instruction, faculty development must focus on both disability-related and general pedagogical training. While disability-related training alone has been traditionally used as the sole mechanism to promote attitudes and practices related to accommodations of student with disabilities, in order to advance universal design and inclusive instruction general pedagogical training needs to play a role as well.

Research question 5. *How effective is a one-time disability-related faculty development workshop in changing faculty attitudes and knowledge in inclusive instruction?*

The above results showed workshops, as a format of faculty disability-related training, to be associated with more positive attitudes, knowledge, and practices in number of areas related to accommodations and inclusive instruction. Additionally, longer disability-related training was found to be more effective than no training overall, and in some areas more effective than training under three hours. This suggests that longer workshops or series of workshops should be the type of training to consider when addressing requirements such as the AODA mandate for educator training in postsecondary institutions in Ontario. Carleton University meets this requirement with the provision of a workshop on accessibility awareness in higher education, called Accessible Learning, which has been offered since 2011. Within the present research project, a separate sample was collected from among the participants of the Accessible Learning workshop, prior and after each workshop session. The objective was to assess short-term effects of the Accessible Learning workshop in areas of inclusive instruction measured by the ITSI. Such pre-post quasi-experimental data are scarce in the current research base on inclusive instruction and universal design, which is dominated by correlational research. Within the present research projects this allowed the findings established within the first four research questions and the main sample to be tested out with a separate sample and a pre-post research design.

The pre-post analyses showed that Accessible Learning workshop was effective in promoting short-term attitudes toward accommodations, accessible course materials, inclusive classroom practices, and flexible methods of assessment, as well as knowledge related to disability laws and

concepts. As a workshop designed to address the AODA requirements for educator training in accessibility awareness in program and course design and delivery, it meets the intended objective. However, as evaluated in this study the measured impact was limited to change in attitudes and knowledge but not practices. Nonetheless, considering the prior findings of consistency between attitudes and practices in inclusive instruction, the positive effect on attitudes and knowledge suggests a likely impact on implementation of related instructional strategies as informed by the universal design guidelines presented in the workshop. It would be worthwhile to extend similar faculty development activities to specifically focus on the practical implementation of inclusive instructional strategies and to measure their impact with longitudinal research designs. The effectiveness of the Accessible Learning workshops confirms the findings from the main sample as discussed earlier, the significant relationship between workshops and positive attitudes and practices in several areas of inclusive instruction. This is in line with previous research that found training activities such as workshops, seminars, or courses to be the most commonly recommended forms of faculty development, and more strongly associated with positive attitudes in inclusive instruction than other forms of training (Murray et al., 2011; Summers, 2008). It is also evident that a longer, yet a one-time workshop is sufficient to influence faculty attitudes and knowledge related to disabilities and inclusive instruction in higher education. The findings from the present study suggest workshops should be considered an effective form of faculty development with advantages over other methods, such as online resources and self-study.

Limitations

A general limitation applicable to any study located within a single institution is the generalizability of findings. Although many of the results in the present study are in line with past research, some findings are not. Future research with different samples will allow for validation of findings obtained with the ITSI instrument. In the context of Carleton University, generalizability of findings from the Accessible Learning workshop sample can be questioned due to the small sample size and the convenience sample with no comparison group, as well as measurement of short-term effects on attitudes and knowledge. While the use of pre-post design and subjects as their own controls ensures control of within-subject confounding factors, the workshop sample may not be representative of the Carleton University faculty population, in contrast to the main sample. It is as much a statement about the Accessible Learning workshop as it is about faculty development activities in general, that self-selection bias is a factor to be mindful of when generalizing findings.

The reliability and construct validity of the ITSI instrument and its subscales warrants further evaluation. This was suggested in the context of the discussion of obtained internal consistency reliability values for each subscale. Two subscales achieved alpha and omega (hierarchical) below the acceptable levels, both of these statistics being premised on the assumption of an underlying single factor (i.e. unidimensionality). One of the two subscales, namely Accessible Course Materials (ACM), has been shown in previous research with ITSI to have lower than generally recommended alpha levels. This prompted an examination of items within the ACM subscale and conceptually related items in other subscales. After three additional items were added to the ACM subscale, an exploratory factor analysis (principal component analysis)

revealed a clear single factor solution with satisfactory amount of variance explained and improvement in internal consistency reliability that exceeded the recommended alpha level. This preliminary analysis of the ACM subscale suggests improvements could be made to internal consistency of the ITSI subscales and warrants additional factor analyses.

One constraint of the ITSI instrument is that the Actions subscales are based on self-report data. The participants in the study retrospectively reported their use in practice of the inclusive instructional strategies. As such it is a general estimate from each participant of the degree of implementation of these strategies in their teaching practice. Reliability of this type of self-report Actions data can be questioned, which can have implications on the interpretation of the association between Attitudes and Actions, as one example. Unfortunately, collection of more objective data on faculty practices, such as continuous reporting, direct observation of such practices in the classroom, and analyses of course designs and materials presents significant challenges. Nevertheless, future studies should investigate ways to use the ITSI instrument to gather more objective data on faculty practices.

Effect sizes for multivariate analyses of variance of the main sample data ranged from small to medium, as measured by partial eta squared (0.03 to 0.08). The effect sizes for significant results on the four ITSI subscales in the Accessible Learning pre-post workshop analyses were all within the medium range as measured by Cohen's *d* (0.5 to 0.7). While large effect sizes are always desirable, the effect sizes obtained in the present study are comparable to the effect sizes observed in past studies with the ITSI instrument by Lombardi and colleagues. Furthermore, with conceptual categories of the kind represented by the ITSI subscales, it is understandable that

variability in the measured outcomes can only be attributed in small degrees to a single factor. Responses to constructs as complex as accommodation or inclusive assessment are influenced by a multitude of factors where a single one such as faculty rank can reasonably show only a small degree of association.

Contribution

The present research project has contributed findings that clarify issues from past research or suggest answers to outstanding questions. The research problem statements summarized a number of such issues and questions based on the literature in this area. The first one was the discrepancy between attitudes and practices with regards to universal design. Such a discrepancy was not found in this study, to the extent that the principles of universal design were represented by the ITSI subscales. This can be interpreted as being a characteristic of the particular culture of inclusivity at Carleton University where attitudes related to specific areas of inclusive instruction are typically realized in practice. It is also likely a conceptual and methodological issue – the ITSI instrument is one of the first, if not the only, validated instrument that has operationalized inclusive instruction and universal design into measurable constructs through factor analyses. More so to the point about discrepancy/consistency between attitudes and practices, it measures both as the two dimensions of each statement in the questionnaire and the resulting subscales. This allows for reliable comparison of attitudes and practices, and as mentioned before the Carleton University sample did not show a discrepancy between the two, suggesting that implementation of strategies in line with universal design is possible and is happening in everyday teaching practices.

A major question in inclusive instruction and universal design has been about faculty training and its effectiveness in promoting such practices. The present study confirms unequivocally that faculty development has a significant relationship with all areas of inclusive instruction as measured by the ITSI instrument. First, we now know that disability-related faculty training positively influences faculty attitudes, knowledge, and practices related to accommodations, accessible course materials, course modifications, inclusive classroom practices, inclusive assessment, and disability laws and concepts. But the present study has also revealed the benefits of general pedagogical training in several areas of inclusive instruction. These findings were tested and confirmed with a separate sample in the present research project where a pre-post measure of the effectiveness of the AODA Accessible Learning workshop showed it influenced faculty attitudes and knowledge in accommodations, accessible course materials, inclusive classroom practices, inclusive assessment, and disability laws and concepts. In other words, faculty development is effective in promoting inclusive instruction, whether the training is disability-related or general.

Related to the above findings about the impact of general pedagogical training in several areas of inclusive instruction, the present study addresses one of the greatest dilemmas with regards to ideas put forth by universal design models – that universal design is fundamentally about good teaching. It is evident that general pedagogical training is a significant predictor of attitudes and practices in accessible course materials, inclusive lecture strategies, inclusive classroom, and inclusive assessment. What is important to note is that this was the case after partialing out the influence of disability-related training. Therefore, these findings suggest that many of the instructional areas derived from the principles of universal design are influenced by general

pedagogical training, lending support to the arguments that many of the strategies advocated by universal design are indeed about sound pedagogical practices, not necessarily unique to universal design and are already addressed by general faculty development. The question that arises is whether this finding undermines the importance of universal design models in promoting inclusive instructional attitudes and practices. It may be that rather than conceptualizing inclusive instruction within distinct theoretical models, our existing faculty development activities should incorporate a dimension of inclusive instruction in all areas of teaching and learning. However, if we are to shift focus from separate models of inclusive instruction to incorporating those principles and strategies into general faculty development, then it cannot be emphasized enough that inclusive instruction must become a core aspect of every level of faculty development. This is not only because general pedagogical training has no impact in some areas, primarily related to accommodations, but because distinct models such as Universal Design for Learning fulfill an important role in faculty development that promotes awareness and education about disabilities and accessibility. They represent ideas and efforts from the many decades of advocating for the rights of persons with disabilities to equitable access and participation in higher education.

One of the major objectives for the present research project was in fact entirely independent from the research topic, and it was to demonstrate the use of statistical methods that are not commonly seen in educational research. These are the techniques widely recognized as best practices, such as the advanced methods for imputation of missing data, alternatives to alpha as a measure of reliability, robust nonparametric procedures less constrained by classical assumptions, bootstrapping as a powerful approach to calculation of confidence intervals and resulting p-

values, or adaptable post-hoc tests to consider in place of the ubiquitous Bonferroni correction. These procedures may seem unfamiliar, too specialized, or even intimidating to students and researchers in education. Yet they address some common issues encountered in education research and research in general that constrain reliable and valid use of research data and their interpretation; such as bias due to missing data, instrument reliability, violations of parametric assumptions, or ill-informed approaches to multiple testing and familywise error. It is hoped that discussion of these advanced statistical methods and application within a research project dealing with themes familiar to students and researchers in education will make them more accessible and promote their use.

In Ontario, the AODA legislation presents ambitious requirements to promote accessibility for persons with disabilities, including the mandated educator training in accessible program and course delivery in postsecondary educational institutions. The present research project was partly inspired by this requirement and has examined the effectiveness of the AODA workshop for this purpose at Carleton University. The findings show that the workshop is effective in promoting attitudes and knowledge in several areas of inclusive instruction as noted above. The workshop analysis as well as a separate analysis from a different sample of faculty in the present research project suggest that workshops or courses as a form of faculty development have advantages over other types of training. This is important considering that the more common approach to meeting the requirements for faculty training, such as the one from AODA, is to rely on static websites or step-by-step online training modules. As illustrated by the structure of the Accessible Learning workshop, in-person faculty training affords many different ways to engage faculty in the process of change in perspectives, attitudes, and practices which cannot be replicated fully in

static online environments or through self-study. It is questionable to what extent the AODA educator training requirement will be realized in Ontario's colleges and universities without the implementation and support for in-person workshops and courses.

Recommendations

In an effort to reduce the implications of the findings from the present research project to an easily digested summary, the following list of practice-oriented recommendations is outlined. To the extent that the sample from Carleton University is representative of higher education faculty in general, these recommendations can be applied as evidence-based to other postsecondary institutions:

1) Focus faculty development efforts in inclusive instruction in particular on tenured faculty and with specific emphasis on presentation of course content in multiple formats, variety in classroom activities, and use of technology to facilitate course activities. Consider the experience of non-tenured faculty as a factor contributing to positive attitudes and practices in inclusive instruction, and solicit their collaboration in faculty development activities.
2) Work more closely with the Faculties of Science and Engineering to promote attitudes, knowledge, and practices in inclusive instruction and accessibility in teaching and learning among their faculty members and instructors. Engage the existing expertise of the faculty from Arts and Social Sciences in faculty development and broader institutional strategies.

3) Offer longer workshops and courses in areas of inclusive instruction. These can be specific to issues of disabilities and accessibility (e.g. informed by universal design models), or can be general faculty development programs that incorporate consideration of inclusive instructional practices. Invest into recruitment planning and activities to attract faculty to such workshops and courses, as attendance may be one of the greatest challenges to overcome in engaging faculty with professional development in inclusive instruction.
4) Whether faculty development activities offered are disability-related or are general with consideration of inclusive instruction, ensure that they are informed by conceptually valid strategies that promote accessibility in learning environments, such as those found in the ITSI instrument.
5) Encourage the use of formal evaluation of faculty development activities or research projects to measure their effectiveness and outcomes, both short and long term. This will contribute much needed research data to advance our understanding of teaching and learning methods that promote access and participation for students experiencing barriers in postsecondary settings.

Higher education faculty are uniquely positioned to improve accessibility in teaching and learning, for students with disabilities but also other underrepresented groups of students encountering barriers in learning. The findings from this research project suggest that our faculty positively endorse both attitudes and practices in inclusive instruction. The consistency between beliefs in the importance of instructional strategies that promote inclusive and accessible learning environments and the reported use of those strategies in their teaching is encouraging. Progressive ideas espoused by pedagogical models such as those based in the principles of

universal design are reflective of high impact pedagogical practices in general. As demonstrated in the present study, general faculty development does in fact promote inclusive instructional practices, but so does the disability-related training, over and above general faculty training. In other words, faculty development overall promotes attitudes and practices in inclusive instruction. The requirements placed on our faculty and faculty development units in universities to meet the needs of students with disabilities, such as the AODA legislation, present a unique challenge to the established teaching practices in higher education. It is nonetheless a problem in a positive sense of the word; a problem that inspires innovation and excellence in the context of the scholarship of teaching (Bass, 1999). The findings in this research project confirm that we have both the means of meeting this challenge through faculty development, and the faculty who are ready to promote inclusive instructional practices and support students who may experience barriers in learning.

APPENDIX A

Inclusive Teaching Strategies Inventory (ITSI)
Subscales, items, and response stems

Contact:
Allison Lombardi, PhD
Assistant Professor
University of Connecticut
allison.lombardi@uconn.edu

Attitudes and Actions Subscales	BV PhD Survey[7] Question Labels		Response Stem: Attitudes: *I believe it's important to…* Actions: *I do…*
	Attitudes	Actions	Item
Accommodations	Q30_1_1	Q30_2_1	allow students with documented disabilities to use technology (e.g. laptop, calculator, spell checker) to complete tests even when such technologies are not permitted for use by students without disabilities
	Q32_1_1	Q32_2_1	provide copies of my lecture notes or outlines to students with documented disabilities
	Q30_1_3	Q30_2_3	provide copies of my overhead and/or PowerPoint presentations to students with documented disabilities
	Q33_1_3	Q33_2_3	allow flexible response options on exams (e.g. change from written to oral) for students with documented disabilities
	Q32_1_2	Q32_2_2	allow students with documented disabilities to digitally record (audio or visual) class sessions
	Q30_1_5	Q30_2_5	make individual accommodations for students who have disclosed their disability to me
	Q30_1_2	Q30_2_2	arrange extended time on exams for students who have documented disabilities
	Q30_1_4	Q30_2_4	extend the due dates of assignments to accommodate the needs of students with documented disabilities

[7] Question numbers as administered in the present research study.

Accessible Course Materials	Q36_1_7	Q36_2_7	use a course website (e.g. Blackboard or faculty web page)
	Q36_1_3	Q36_2_3	put my lecture notes online for ALL students (on Blackboard or another website)
	Q36_1_6	Q36_2_6	post electronic versions of course handouts
	Q34_1_2	Q34_2_2	allow students flexibility in submitting assignments electronically (e.g. mail attachment, digital drop box)
Course Modifications	Q32_1_3	Q32_2_3	allow a student with a documented disability to complete extra credit assignments
	Q32_1_4	Q32_2_4	reduce the overall course reading load for a student with a documented disability even when I would not allow a reduced reading load for another student
	Q33_1_2	Q33_2_2	reduce the course reading load for ANY student who expresses a need
	Q33_1_1	Q33_2_1	allow ANY student to complete extra credit assignments in my course(s)
Inclusive Lecture Strategies	Q35_1_2	Q35_2_2	repeat the question back to the class before answering when a question is asked during a class session
	Q35_1_3	Q35_2_3	begin each class session with an outline/agenda of the topics that will be covered
	Q35_1_4	Q35_2_4	summarize key points throughout each class session
	Q35_1_5	Q35_2_5	connect key points with larger course objectives during class sessions
Inclusive Classroom	Q36_1_4	Q36_2_4	use technology so that my course material can be available in a variety of formats (e.g. podcast of lecture available for download, course readings available as mp3 files)
	Q35_1_6	Q35_2_6	use interactive technology to facilitate class communication and participation (e.g. Discussion Board)
	Q36_1_5	Q36_2_5	present course information in multiple formats (e.g. lecture, text, graphics, audio, video, hands-on exercises)
	Q36_1_1	Q36_2_1	create multiple opportunities for engagement
	Q36_1_2	Q36_2_2	survey my classroom in advance to anticipate any physical barriers
	Q34_1_5	Q34_2_5	include a statement in my syllabus inviting students with disabilities to discuss their needs with me

	Q34_1_4	Q34_2_4	make a verbal statement in class inviting students with disabilities to discuss their needs with me
	Q35_1_1	Q35_2_1	use a variety of instructional formats in addition to lecture, such as small groups, peer assisted learning, and hands on activities
	Q35_1_7	Q35_2_7	supplement class sessions and reading assignments with visual aids (e.g. photographs, videos, diagrams, interactive simulations)
Inclusive Assessment	Q34_1_1	Q34_2_1	allow students to demonstrate the knowledge and skills in ways other than traditional tests and exams (e.g. written essays, portfolios, journals)
	Q34_1_3	Q34_2_3	allow students to express comprehension in multiple ways
	Q33_1_4	Q33_2_4	be flexible with assignment deadlines in my course(s) for ANY student who expresses a need
	Q33_1_5	Q33_2_5	allow flexible response options on exams (e.g., change from written to oral) for ANY student who expresses a need

Knowledge subscales	BV PhD Survey Question Labels	Response stem: *I am confident in…*
Disability Law & Concepts	Q26_3	my understanding of the Americans with Disabilities Act (1990) (BV: AODA)
	Q26_4	my responsibilities as an instructor to provide or facilitate disability related accommodations
	Q26_5	my knowledge to make adequate accommodations for students with disabilities in my course(s)
	Q26_2	my understanding of section 504 of the Rehabilitation Act of 1973 (BV: duty to accommodate under OHRC)
	Q26_6	my understanding of Universal Design
	Q26_1	my understanding of the legal definition of disability

		Response stem: *I know…*
Campus Resources	Q28_1	I know a Disability Services office exists on this campus
	Q28_2	I know what type of services are provided by the Disability Services office on this campus
	Q28_3	I know students with documented disabilities on this campus receive adequate services from the Disability Services Office
	Q28_4	I know where I can find additional support at this university when students with disabilities are having difficulties in my course

REFERENCES

Alghazo, R. (2008). *Disability attitudes of postsecondary faculty members and perspectives regarding educational accommodation* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (304474773)

Allison, P. D. (2009). Missing data. In R. E. Millsap & A. Maydeu-Olivares (Eds.), *The SAGE handbook of quantitative methods in psychology* (pp. 72-89). London: SAGE Publications Ltd.

Alliston, J. R. (2011). *Postsecondary education of students with disabilities: Review of faculty and of students with disabilities perceptions for training*. (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (757360620)

Ambrosino, R. R. (2007). *Faculty development programs at state universities toward the goal of academic accessibility for students with learning disabilities: A Delphi study of key program characteristics within variable campus cultures*. (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (304708539)

Andridge, R. R., & Little, R. J. (2010). A review of hot deck imputation for survey nonresponse. *International Statistical Review, 78*(1), 40-64.

Baraldi, A. N., & Enders, C. K. (2010). An introduction to modern missing data analyses. *Journal of School Psychology, 48*(1), 5-37. http://dx.doi.org/10.1016/j.jsp.2009.10.001

Bass, R. (1999). The scholarship of teaching: what's the problem? *Inventio*, *1*(1), 1-9.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society, Series B,* 289-300.

Benjamini, Y., & Hochberg, Y. (2000). On the adaptive control of the false discovery rate in multiple testing with independent statistics. *Journal of Educational and Behavioral Statistics, 25*(1), 60-83.

Benjamini, Y., & Yekutieli, D. (2001). The control of the false discovery rate in multiple testing under dependency. *The Annals of Statistics, 29*(4), 1165-1188.

Black, R. D., Weinberg, L. A., & Brodwin, M. G. (2014). Universal design for instruction and learning: A pilot study of faculty instructional methods and attitudes related to students with disabilities in higher education. *Exceptionality Education International, 24*(1), 48-64.

Bourke, A. B., Strehorn, K. C., & Silver, P. (2000). Faculty members' provision of instructional accommodations to students with LD. *Journal of Learning Disabilities, 33*(1), 26-32.

Bowe, F. G. (2000). *Universal design in education: Teaching nontraditional students*. Westport, CT: Bergin & Garvey.

Brandt, J. (2007). 2005 INS presidential address: Neuropsychological crimes and misdemeanors. *Clinical Neuropsychologist, 21*(4), 553-568.

Brinckerhoff, L. C., McGuire, J. M., & Shaw, S. F. (2002). *Postsecondary education and transition for students with learning disabilities.* Austin, TX: *PRO-ED.*

Burgstahler, S. (2001). *Universal design of instruction (UDI): Definition, principle, guidelines, and examples.* Retrieved from http://www.washington.edu/doit/Brochures/Academics/instruction.html

Burgstahler, S., & Cory, R. (2008). *Universal design in higher education: From principles to practice*. Boston: Harvard Education Press.

Burgstahler, S., & Doe, T. (2006). Improving postsecondary outcomes for students with disabilities: Designing professional development for faculty. *Journal of Postsecondary Education and Disability, 18*(2), 135-147.

Canadian College Student Survey Consortium. (2009). *Canadian college student survey.* Montreal, QC: Canadian Millennium Scholarship Foundation.

Canadian University Survey Consortium. (2011). *Undergraduate university student survey: Master report*. Retrieved from http://www.cusc-ccreu.ca/publications/CUSC_2011_UG_MasterReport.pdf

Carifio, J., & Perla, R. J. (2007). Ten common misunderstandings, misconceptions, persistent myths and urban legends about Likert scales and Likert response formats and their antidotes. *Journal of Social Sciences, 3*(3), 106-116.

Center for Universal Design. (2011). *The principles of universal design.* Retrieved from http://www.ncsu.edu/project/design-projects/udi/center-for-universal-design/history-of-universal-design/

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Hillsdale, NJ: L. Erlbaum Associates.

Cook, B. G., Rumrill, P. D., Camarata, J., Mitchell, P. R., Newman, S., Sebaly, K. P., … Hennessey, M. L. (2006). The impact of a professional development institute on faculty members' interactions with college students with learning disabilities. *Journal of Postsecondary Education and Disability, 14*(1), 67-76.

Cook, L. H. (2007). *Faculty members' priorities and understanding regarding university students with disabilities* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (304835558)

Cook, L., Rumrill, P. D., & Tankersley, M. (2009). Priorities and understanding of faculty members regarding college students with disabilities. *International Journal of Teaching and Learning in Higher Education, 21*, 84-96.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of applied psychology*, *78*(1), 98.

Debrand, C. C., & Salzberg, C. L. (2004). A validated curriculum to provide training to faculty regarding students with disabilities in higher education. *Journal of Postsecondary Education and Disability, 18*(1), 49-62.

Denhart, H. (2008). Perceptions of students labeled with learning disabilities in higher education. *Journal of Learning Disabilities, 41*, 483- 497.

Dunn, T. J., Baguley, T., & Brunsden, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology, 105*(3), 399-412.

Edyburn , D. L. (2010). Would you recognize Universal Design for Learning if you saw it? Ten propositions for the second decade of UDL. *Learning Disability Quarterly, 33*, 1-41.

Enders, C. K. (2003). Performing multivariate group comparisons following a statistically significant MANOVA. *Measurement and Evaluation in Counseling and Development*, *36*, 40-56.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics.* London, UK: Sage Publications Ltd.

Field, A., Miles, J., & Field, Z. (2012). *Discovering statistics using R*. London, UK: SAGE Publications Ltd.

Finch, H., & French, B. (2013). A Monte Carlo comparison of robust MANOVA test statistics. *Journal of Modern Applied Statistical Methods, 12*(2), 35-81.

Flaherty, M., & Roussy, A. (2014). A failed game changer: post-secondary education and the Accessibility for Ontarians with Disabilities Act. *Education & Law Journal, 24(1)*, 1-23.

Frane, A. V. (2015). Power and Type I error control for univariate comparisons in multivariate two-group designs. *Multivariate Behavioral Research, 50(2)*, 233-247.

Gadermann, A. M., Guhn, M., & Zumbo, B. D. (2012). Estimating ordinal reliability for Likert-type and ordinal item response data: A conceptual, empirical, and practical guide. *Practical Assessment, Research & Evaluation, 17*(3), 1-13.

Getzel, E. E., Briel, L. W., & McManus, S. (2003). Strategies for implementing professional development activities on college campuses: Findings from the OPE funded project sites (1999–2002). *Journal of Postsecondary Education and Disability, 17*(1), 11–21.

Gitlow, L. (2001). Occupational therapy faculty attitudes toward the inclusion of students with disabilities in their educational programs. *The Occupational Therapy Journal of Research, 21*, 115-131.

Graham, J. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60*, 549-576.

Graham, J. W. (2012). *Missing data: Analysis and design*. New York, NY: Springer.

Graham, J. W., Olchowski, A. E., & Gilreath, T. D. (2007). How many imputations are really needed? Some practical clarifications of multiple imputation theory. *Prevention Science*, *8*(3), 206-213.

Green, S. B., & Yang, Y. (2009). Commentary on coefficient alpha: A cautionary tale. *Psychometrika*, *74*(1), 121-135.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). New York, NY: Pearson International.

Hatfield, J. P. (2003). Perceptions of Universal (Instructional) Design: A qualitative examination. In J. L. Higbee (Ed.), *Curriculum transformation and disability: Implementing Universal Design in higher education* (pp. 41-58). Minneapolis, MN: University of Minnesota.

Higbee, J. L., & Goff, E. (Eds.). (2008). *Pedagogy and student services for institutional transformation: Implementing Universal Design in higher education*. Minneapolis, MN: University of Minnesota.

Hindes, Y., & Mather, J. (2007). Inclusive education at the post-secondary level: Attitudes of students and professors. *Exceptionality Education Canada, 17*(1), 107-127.

Howell, D. C. (1995). *Fundamental statistics for the behavioral sciences* (3rd ed.). Belmont, CA: Duxbury.

Huberty, C. J., & Morris, J. D. (1989). Multivariate analysis versus multiple univariate analyses. *Psychological Bulletin, 105*(2), 302-308. doi: http://dx.doi.org/10.1037/0033-2909.105.2.302

Human Resources and Skills Development Canada. (2011). *Disability in Canada: A 2006 profile.* Retrieved from http://www.hrsdc.gc.ca/eng/disability_issues/reports/disability_profile/2011/fact_sheet/education.shtml

IBM Corporation. (2013a). IBM SPSS Statistics for Windows (Version 22.0) [Software]. Armonk, NY: IBM Corporation.

IBM Corporation. (2013b). IBM SPSS missing values 22. Retrieved from http://www.sussex.ac.uk/its/pdfs/SPSS_Missing_Values_22.pdf

IBM Corporation. (2015). IBM SPSS Statistics for Windows (Version 23.0) [Software]. Armonk, NY: IBM Corporation.

Izzo, M. V., Murray, A., & Novak, J. (2008). The faculty perspective on universal design for learning. *Journal of Postsecondary Education and Disability, 21*(2), 60-72.

Jensen, J. M., McCrary, N., Krampe, K., & Cooper, J. (2004). Trying to do the right thing: Faculty attitudes toward accommodating students with learning disabilities. *Journal of Postsecondary Education and Disabilities, 17*(2), 81-90.

Jones, W. P., & Loe, S. A. (2013). Optimal number of questionnaire response categories. *Sage Open*, *3*(2), 1-10.

Kane, R., Sandretto, S., & Heath, C. (2002). Telling half the story: A critical review of research on the teaching beliefs and practices of university academics. *Review of educational research*, *72*(2), 177-228.

Katsiyannis, A., Zhang, D., Landmark, L., & Reber, A. (2009). Postsecondary education for individuals with disabilities: Legal and practice considerations. *Journal of Disability Policy Studies, 20*(1), 35-45.

Keselman, H. J., Huberty, C. J., Lix, L. M., Olejnik, S., Cribbie, R., Donahue, B., … Levin, J. (1998). Statistical practices of educational researchers: An analysis of their ANOVA, MANOVA and ANCOVA analyses. *Review of Educational Research*, 68, 350-386.

Ketterlin-Geller, L., & Johnstone, C. (2006). Accommodations and universal design: Supporting access to assessments in higher education. *Journal of Postsecondary Education and Disability, 19*(1), 163-171.

Kumar, K. L., & Wideman, M. (2014). Accessible by design: Applying UDL principles in a first year undergraduate course. *The Canadian Journal of Higher Education, 44*(1), 125-147.

Lahaut, V. M. H. C. J., Jansen, H. A. M., van de Mheen, D., Garretsen, H. F. L., Verdurmen, J. E. E., & van Dijk, A. (2003). Estimating non-response bias in a survey on alcohol consumption: Comparison of response waves. *Alcohol and Alcoholism, 38*(2), 128-134.

Lehmann, J. P., Davies, T. G., & Laurin, K. M. (2000). Listening to student voices about postsecondary education. *Teaching Exceptional Children, 32*(5), 60-65.

Leite, W., & Beretvas, S. N. (2010). The performance of multiple imputation for Likert-type items with missing data. *Journal of Modern Applied Statistical Methods*, *9*(1), 64-74.

Leyser, Y., & Greenberger, L. (2008). College students with disabilities in teacher education: Faculty attitudes and practices. *European Journal of Special Needs Education, 23*(3), 237-251.

Leyser, Y., Greenberger, L., Sharoni, V., & Vogel, G. (2011). Students with disabilities in teacher education: Changes in faculty attitudes toward accommodations over ten years. *International Journal of Special Education, 26*(1), 162-174.

Leyser, Y., Vogel, S., Wyland, S., Brulle, A., Sharoni, V., & Vogel, G. (2003). American and Israeli faculty attitudes and practices regarding students with learning disabilities: A cross-cultural study. In, S.A Vogel, G. Vogel, V. Sharoni, & O. Dahan (Eds.), *Learning Disabilities in Higher Education and Beyond. An International Perspective* (pp: 201-225). Baltimore, MD: York Press.

Little, R. J. A., & Rubin, D. B. (1987). *Statistical analysis with missing data.* New York: Wiley.

Lombardi, A. (2010). *Measuring faculty attitudes and perceptions toward disability at a four-year university: A validity study* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (305214056)

Lombardi, A., Murray, C., & Dallas, B. (2013). University faculty attitudes toward disability and inclusive instruction: Comparing two institutions. *Journal of Postsecondary Education and Disability*, *26*(3), 221-232.

Lombardi, A. R., & Murray, C. (2011). Measuring university faculty attitudes toward disability: Willingness to accommodate and adopt Universal Design principles. *Journal of Vocational Rehabilitation, 34*(1), 43-56.

Lombardi, A. R., Murray, C., & Gerdes, H. (2011). College faculty and inclusive instruction: Self-reported attitudes and actions pertaining to Universal Design. *Journal of Diversity in Higher Education*. *4*(4), 250-261.

Lombardi, A. R., & Sala-Bars, I. (2013, July). *An international examination of postsecondary faculty attitudes and actions toward inclusive instruction: Comparing the United States and Spain.* Concurrent session presented at the 8th International Conference on Higher Education and Disability. Innsbruck, Austria.

Madaus, J. W., Scott, S., & McGuire, J. (2003a). *Barriers and bridges to learning as perceived by postsecondary students with learning disabilities*. Mansfield, CT: Center on Postsecondary Education and Disability, University of Connecticut.

Madaus, J. W., Scott, S., & McGuire, J. (2003b). *Addressing student diversity in the classroom: The approaches of outstanding university professors.* Mansfield, CT: Center on Postsecondary Education and Disability, University of Connecticut.

Manfreda, K. L., Bosnjak, M., Berzelak, J., Haas, I., & Vehovar, V. (2008). Web surveys versus other survey modes. *International Journal of Market Research, 50*(1), 79-104.

Matsunaga, M. (2007). Familywise error in multiple comparisons: Disentangling a knot through a critique of O'Keefe's arguments against alpha adjustment. *Communication Methods and Measures, 1*(4), 243-265.

Maxwell, S. E., & Delaney, H. D. (2004). *Designing experiments and analyzing data: A model comparison perspective* (2nd ed.). Mahwah, NJ: Erlbaum.

McGuire, J. M. (2011). Inclusive college teaching: Universal Design for Instruction and diverse learners. *Journal of Accessibility and Design for All, 1*(1), 38-54.

McGuire, J. M., Scott, S. S., & Shaw, S. F. (2003). Universal Design for Instruction: The paradigm, its principles, and products for enhancing instructional access. *Journal of Postsecondary Education and Disability, 17*(1), 11-21.

McKnight, P. E., McKnight, K. M., & Sidani, S. (2007). *Methodology in the social sciences: Missing data, a gentle introduction*. New York, US: The Guilford Press.

Miles, J., & Shevlin, M. (2001). *Applying regression and correlation: A guide for students and researchers*. London, UK: Sage Publications Ltd.

Miller, L. E., & Smith, K. L. (1983). Handling nonresponse issues. *Journal of Extension, 21*(5), 45-50.

Milligan, N. V. (2010). The effects of training about academic accommodations on perceptions and intentions of health science faculty. *Journal of Allied Health, 39*(1), 54-61.

Morris, S. B., & DeShon, R. P. (2002). Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychological Methods*, *7*(1), 105-125.

Murray, C., Flannery, B. K., & Wren, C. (2008). University staff members' attitudes and knowledge about learning disabilities and disability support services. *Journal of Postecondary Education and Disability, 21*(1), 73–90.

Murray, C., Lombardi, A. R., & Wren., C. (2011). The effects of disability-focused training on the attitudes and perceptions of university staff. *Remedial and Special Education*, *32*(4), 290-300.

Murray, C., Lombardi, A. R., Wren, C., & Keys, C. (2009). The effects of disability-focused training on attitudes and perceptions of university staff. *Learning Disability Quarterly, 32*(2), 87-102.

Murray, C., Wren, C., & Keys, C. (2008). University faculty perceptions of students with learning disabilities: Correlates and group differences. *Learning Disability Quarterly, 31*(1), 1-19.

Murray, C., Wren, C., Stevens, E., & Keys, C. (2009). Promoting university faculty and staff awareness of students with learning disabilities: An overview of the productive learning u strategies (PLUS) project. *Journal of Postsecondary Education and Disability, 22*(2), 117-129.

Nakagawa, S. (2004). A farewell to Bonferroni: The problems of low statistical power and publication bias. *Behavioral Ecology, 15*(6), 1044-1045.

National Center on Universal Design for Learning. (2011). *UDL Guidelines version 2.0: Research evidence*. Retrieved from: http://www.udlcenter.org/research/researchevidence

Nelson, J. R., Dodd, J. M., & Smith, D. J. (1990). Faculty willingness to accommodate students with learning disabilities: A comparison of academic divisions. *Journal of Learning Disabilities, 23*, 185-189.

Newman, L., Wagner, M., Knokey, A.-M., Marder, C., Nagle, K., Shaver, D., … Schwarting, M. (2011). *The post-high school outcomes of young adults with disabilities up to 8 years after high school. A report from the National Longitudinal Transition Study-2 (NLTS2)* (NCSER 2011-3005). Menlo Park, CA: SRI International.

Norman, G. (2010). Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education, 15*(5), 625-632.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*: New York, NY: McGraw-Hill.

O'Keefe, D. J. (2003). Colloquy: Should familywise alpha be adjusted? *Human Communication Research, 29*(3), 431-447.

Ontario Gazette. (2011). *Accessibility for Ontarians with Disabilities Act (AODA): Integrated Accessibility Standards* (Ontario Regulation 191/11). Retrieved from http://www.e-laws.gov.on.ca/html/source/regs/english/2011/elaws_src_regs_r11191_e.htm

Orr, A. C., & Hammig, S. B. (2009). Inclusive postsecondary strategies for teaching students with learning disabilities: A review of the literature. *Learning Disability Quarterly, 32*(2), 181-196.

Ouellett, M. L. (2004). Faculty development and universal instructional design. *Equity. & Excellence in Education, 37*(2), 135-144.

Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *British Medical Journal, 316*, 1236-1238.

Pituch, K. A., & Stevens, J. (2016). *Applied multivariate statistics for the social sciences: Analyses with SAS and IBM's SPSS* (6th ed.). New York, NY: Routledge.

Pollard, K. S., Dudoit, S., & van der Laan, M. J. (2005). Multiple testing procedures: The multtest package and applications to genomics. In R. Gentleman, V. J. Carey, W. Huber,

R. A. Irizarry, & S. Dudoit (Eds.), *Bioinformatics and computational biology solutions using R and bioconductor* (pp. 249-271). New York, NY: Springer.

R Core Team. (2015). R: A language and environment for statistical computing (Version 3.2.3.) [Computer software]. Available from https://www.R-project.org/.

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A review of research on universal design educational models. *Remedial and Special Education, 35*(3), 153-166.

Rao, S. (2004). Faculty attitudes and students with disabilities in higher education: A literature review. *College Student Journal*, *38*(2), 191-199.

Rao, S., & Gartin, B. C. (2003). Attitudes of university faculty toward accommodations to students with disabilities. *Journal of Vocational Special Needs Education, 25*(2), 47-54.

Raue, K., & Lewis, L. (2011). *Students with disabilities at degree-granting postsecondary institutions* (NCES-2011-018). Washington, DC: U.S. Government Printing Office.

Revelle, W., & Zinbarg, R. E. (2009). Coefficients alpha, beta, omega, and the glb: Comments on Sijtsma. *Psychometrika, 74*(1), 145-154.

Roberts, K., Park, H. J., Brown, S., & Cook, B. (2011). Universal design for Instruction in postsecondary education: A systematic review of empirically based articles. *Journal of Postsecondary Education and Disability, 24*(1), 5-15.

Robinson, J. P., Shaver, P. R., & Wrightsman, L. S. (1991). Criteria for scale selection and evaluation. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman, (Eds.), *Measures of personality and social psychological attitudes* (pp. 1-16). Boston, MA: Academic Press.

Rodesiler, C. A., & McGuire, J. M. (2015). Ideas in practice: Professional development to promote Universal Design for Instruction. *Journal of Developmental Education, 38*(2), 24.

Rohland, P., Erickson, B., Mathews, D., Roush, S. E., Quinlan, K., & Smith, A. D. (2003). Changing the culture (CTC): A collaborative training model to create systematic change. *Journal of Postsecondary Education and Disability, 17*(1), 49-58.

Rose, D., & Meyer, A. (2006). *A practical reader in Universal Design for Learning*. Cambridge, MA: Harvard Education Press.

Rose, D. H., Harbour, W. W., Johnston, C. S., Daley, S. G., & Abarbanell, L. (2008). Universal Design for Learning in postsecondary education: Reflections on principles and their application. In S. E. Burgstahler & R. C. Cory (Eds.), *Universal design: From principles to practice* (pp. 45-59). Cambridge, MA: Harvard Education Press.

Salzberg, C. L., Peterson, L., Debrand, C., Blair, R. J., Carsey, A. C., & Johnson, A. S. (2002). Opinions of disability service directors on faculty training: The need, content issues, formats, media and activities. *Journal of Postsecondary Education and Disability, 15*(2), 101-114.

Schafer, J. (2005, Nov). *Missing data in longitudinal studies: A review.* Paper presented at the AAPS, Nov 2005, Nashville, Tennessee.

Schafer, J. L. (1999). Multiple imputation: A primer. *Statistical Methods in Medical Research, 8*(1), 3-15.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological methods*, *7*(2), 147-177.

Schelly, C. L., Davies, P. L., & Spooner, C. L. (2011). Student perceptions of faculty implementation of Universal Design for Learning. *Journal of Postsecondary Education and Disability, 24*(1), 17-30.

Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counselling Psychology*, 57(1), 1-10.

Scott, S., & Gregg, G. (2000). Meeting the evolving educational needs of faculty in providing access for college students with LD. *Journal of Learning Disabilities, 33*(2), 158-167.

Scott, S. T., McGuire, J. M., & Shaw, S. F. (2003). Universal Design for Instruction: A new paradigm for adult instruction in postsecondary education. *Remedial and Special Education, 24*(6), 369-379.

Sharpe, D. (2015). Your chi-square test is statistically significant: Now what? *Practical Assessment, Research & Evaluation, 20*(8), 1-10.

Shaw, R. A. (2011), Employing universal design for instruction. *New Directions for Student Services*, *134,* 21–33.

Shaw, S. F., & Scott, S. S. (2003). New directions in faculty development. *Journal of Postsecondary Education and Disability, 17*(1), 3–9.

Shih, T.-H., & Fan, X. (2009). Comparing response rates in e-mail and paper surveys: A meta-analysis. *Educational Research Review, 4*(1), 26-40.

Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's alpha. *Psychometrika*, *74*(1), 107-120.

Silver, P., Bourke, A., & Strehorn, K. C. (1998). Universal Instructional Design in higher education: An approach for inclusion. *Equity and Excellence in Education, 31*(2), 47-51.

Skinner, M. E. (2004). College students with learning disabilities speak out: What it takes to be successful in postsecondary education. *Journal of Postsecondary Education and Disability, 17*(2), 91-104.

Sowers, J. A., & Smith, M. R. (2004a). Nursing faculty members' perceptions, knowledge, and concerns about students with disabilities. *Journal of Nursing Education, 43*(5), 213–218.

Sowers, J. A., & Smith, M. R. (2004b). Evaluation of the effects of an inservice training program on nursing faculty members' perception, knowledge, and concerns about students with disabilities. *Journal of Nursing Education, 43*(6), 248-252.

Statistics Canada. (2011). *Persons with disabilities, by age group and sex (2006)* [Data file]. Retrieved from http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/health71a-eng.htm

Summers, T. (2008). *A Phenomenological examination of postsecondary faculty experiences teaching adults with disabilities* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (304779627)

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (4th ed.). Boston, MA: Pearson/Allyn & Bacon.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson Education.

Teo, T., & Fan, X. (2013). Coefficient Alpha and beyond: Issues and alternatives for educational research. *The Asia-Pacific Education Researcher*, *22*(2), 209-213.

Tutzauer, F. (2003). On the sensible application of familywise alpha adjustment. *Human Communication Research, 29*(3), 455-463.

U.S. Department of Education (2011a). *Demonstration projects to ensure students with disabilities receive a quality higher education.* Retrieved from http://www2.ed.gov/programs/disabilities/index.html

U.S. Department of Education (2011b). *Demonstration projects to ensure students with disabilities receive a quality higher education: Grantee-level performance results 2006–07.* Retrieved from http://www2.ed.gov/programs/disabilities/dd-gl-analysis0607.pdf

U.S. Government Accountability Office. (2009). *Higher education and disability: Education needs a coordinated approach to improve its assistance to schools in supporting students* (GAO Publication GAO-10-33). Retrieved from http://www.gao.gov/new.items/d1033.pdf

Vasek, D. (2005). Assessing the knowledge base of faculty at a private, four year institution. *College Student Journal, 39*(2), 307-315.

Vogel, S. A., Holt, J. K., Sligar, S., & Leake, E. (2008). Assessment of campus climate to enhance student success. *Journal of Postsecondary Education and Disability, 21*(1), 15-31.

Vogel, S. A., Leyser, Y., Burgstahler, S., Sligar, S. R., & Zecker, S. G. (2006). Faculty knowledge and practices regarding students with disabilities in three contrasting institutions of higher education. *Journal of Postsecondary Education and Disability, 18*(1), 109–123.

von Hippel, P. T. (2013). Should a normal imputation model be modified to impute skewed variables?. *Sociological Methods & Research*, *42*(1), 105-138.

Wagner, J. (2012). A comparison of alternative indicators for the risk of nonresponse bias. *Public Opinion Quarterly, 76*(3), 555-575.

Ward, H. C., & Selvester, P. M. (2012). Faculty learning communities: improving teaching in higher education. *Educational Studies, 38*(1), 111-121.

Warne, R. T. (2014). A primer on multivariate analysis of variance (MANOVA) for behavioral scientists. *Practical Assessment, Research & Evaluation, 19*(17), 1-10.

Westfall, P. H., & Young, S. S. (1993). *Resampling-based multiple testing: Examples and methods for p-value adjustment*. New York, NY: Wiley.

Wilcox, R. R. (2012). *Introduction to robust estimation and hypothesis testing*. Boston, MA: Academic Press.

Wilkinson, L. (1999). Statistical methods in psychology journals: Guidelines and explanations. *American Psychologist, 54*(8), 594-604.

Wilson, K., Getzel, E., & Brown, T. (2000). Enhancing the postsecondary campus climate for students with disabilities. *Journal of Vocational Rehabilitation, 14*(1)*,* 37–50.

Zeff, R. (2007). Universal design across the curriculum. *New Directions for Higher Education, 137*, 27-44.

Zhang, D., Landmark, L., Reber, A., Hsu, H., Kwok, O.-m., & Benz, M. (2010). University faculty knowledge, beliefs, and practices in providing reasonable accommodations to students with disabilities. *Remedial and Special Education, 31*(4), 276-286.

Zijlstra, W. P., van der Ark, L. A., & Sijtsma, K. (2011). Outliers in questionnaire data: Can they be detected and should they be removed? *Journal of Educational and Behavioral Statistics, 36*(2), 186-212.

Zinbarg, R. E., Yovel, I., Revelle, W., & McDonald, R. P. (2006). Estimating generalizability to a latent variable common to all of a scale's indicators: A comparison of estimators for ωh. *Applied Psychological Measurement, 30*(2), 121-144.