Pre-service Teachers' Beliefs: Impact of Training in Universal Design for Learning

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Abstract

Seventy-seven pre-service teachers enrolled in an introductory special education course completed a questionnaire on their beliefs about learning, teaching, and disability, before and after completing one of two randomly assigned training modules on Universal Design for Learning (UDL). Module A presented UDL as a strategy for meeting the specific needs of students with disabilities in a general education setting. Module B presented UDL as a framework to support all learners in the general education classroom through the creation of communities of learners. The Beliefs About Learning, Teaching, and Disability Questionnaire (BLTDQ) was administered with five subscales rated on a 6-point Likert-type scale that measure pre-service teachers' beliefs about learning and teaching, as representative of their epistemological beliefs, beliefs about disability (from pathognomonic to interventionist) and the role of the teacher in the general education classroom. Analyses of these results suggest that a significant change toward interventionist beliefs about learning, teaching, and disability occurred for participants who completed either module on UDL. Additionally, a small to moderate, positive relationship was identified between pre-service teachers' beliefs about disability and their epistemological beliefs, with the strength of this relationship increasing following their training in UDL. These findings suggest that training in UDL can have a powerful and positive impact on pre-service teachers' interventionist epistemological beliefs and beliefs about disability. Shifts toward interventionist beliefs are more likely to result in teaching practices that are more supportive of students with disabilities in general education classrooms. Implications for teacher preparation and study limitations are also discussed.

In the United States during the 2015–2016 school year, nearly 63% (62.7%) of all students receiving special education services, ages 6 through 21, were served in the general education classroom for 80% of the day, or more (U.S. Department of Education, 2017). This percentage is up from nearly 54% (53.6%) in 2005 (U.S. Department of Education, 2007). Students with disabilities are being placed in the general education classroom for the majority of the school day at an increasing rate. Such increases are occurring against the backdrop of ongoing debates about the distinction between the least restrictive environment and inclusion (Artiles & Kozleski, 2016) and about a clear definition of inclusion (Ainscow, Dyson, & Weiner, 2012; Crockett, 2014). Though Crockett (2014) noted that no consistent definition of inclusion has been established, various definitions of inclusion have been proffered in the literature. For example, Kauffman, Anastasiou, Badar, Travers, and Wiley (2016) suggested that inclusive education should occur in the general education classroom if that is the learning environment in which students are most likely to learn the skills necessary for future success. Artiles and Kozleski (2016) suggested that inclusion is the enhancement of “educational access, participation, and outcomes for students from **all** backgrounds, independent of any form of difference that students purportedly embody” (p. 9). Fundamental discourses on beliefs about disability and inclusion may be at the heart of these differences.

Teachers’ Beliefs About Disability and About Teaching Students with Disabilities

Several major factors seem to impact teacher beliefs about disability, about students with disabilities, and about teaching students with disabilities in inclusive settings. These factors include teachers’ senses of preparation, particularly related to teacher preparation (e.g., Ajuwon et al., 2012; Cook, 2002; Scruggs & Mastropieri, 1996), prior experiences with persons who have disabilities (e.g., Alghazo, Dodeen, & Algaryouti, 2003; Forlin & Chambers, 2011), beliefs about disability, including perceived severity of a disability (e.g., Cook & Cameron, 2010; Jordan, Schwartz, & McGhie-Richmond, 2009; McHatton & Parker, 2013), and teacher self-efficacy (e.g., Dunst & Bruder, 2013; Silverman, 2007).

Along with the factors affecting teachers’ beliefs noted in these studies, some research focused on the relationship between teachers’ beliefs about knowledge and learning and their beliefs about disability and teaching students with disabilities in general education settings (Glenn, 2007; Jordan & Stanovich, 2003; Sheehy, Budiyanto, & Rofiah, 2017; Silverman, 2007). Silverman (2007) described epistemological beliefs as existing along a continuum from naïve to high level. At the naïve end of this continuum are beliefs in which knowledge consists of discrete facts, learning occurs quickly or not at all, and the ability to acquire knowledge is endowed at birth. At the other end of the continuum are beliefs that knowledge is complex, learning is improvable and gradual, and that learners can be active constructors of knowledge (Schraw, 2013; Silverman, 2007). Epistemological beliefs are closely aligned with beliefs about ability and the variable role of effort. Dweck (1999) identifies entity beliefs as those that suggest that ability is fixed, aligning with the naïve epistemological beliefs. Incremental beliefs are those that suggest that learning can occur from good teaching, study, and practice, aligning with high level epistemological beliefs (Dweck, 1999).

Silverman (2007) reported on a study comparing epistemological beliefs and attitudes toward inclusion among 71 pre-service teachers. Silverman found a statistically significant association between participants' high-level epistemological beliefs and attitudes toward including students with disabilities. Sheehy et al. (2017) conducted a study among 267 Indonesian teachers from regular, special, and inclusive schools to evaluate the degree to which epistemological beliefs would predict the teachers' beliefs about inclusive education. They developed and administered a 40-item questionnaire with items relating to beliefs about models of learning (i.e., constructivist, social constructivist, and behaviourist), beliefs about the nature of ability, beliefs about happiness, and the use of manual signing as a proxy for beliefs about the stigmatization of difference. Study results indicated that teachers' epistemological beliefs were highly predictive of their beliefs about inclusive education.

A series of studies conducted by Jordan and colleagues (Jordan, Glenn, & McGhie-Richmond, 2010; Jordan, Lindsay, & Stanovich, 1997; Jordan et al., 2009; Jordan & Stanovich, 2003; Stanovich & Jordan, 1998; see also Jordan, 2018a, 2018b in this issue for a recent summary) reported on their exploration of teacher beliefs about disability and the role of the teacher in supporting students with disabilities in the general education classroom. The Supporting Effective Teaching (SET) project reported on the development and implementation of the Pathognomonic-Interventionist (P-I) Interview, a questionnaire that sought to uncover such a relationship. Jordan et al. (1997) found that teachers are less likely to take responsibility for their students with disabilities when they believe that disability is a fixed property of the student. Jordan et al. (1997) classified such beliefs as pathognomonic. Conversely, teachers are more likely to engage positively and take responsibility for students with disabilities when they hold interventionist beliefs, whereby disability is seen as a function of the interaction between an impairment and the learning environment (Jordan et al., 1997; Jordan et al., 2010).

Glenn (2007) investigated the relationship between entity-increment (E-I) beliefs about ability and P-I beliefs about disability among 120 pre-service and 66 practising teachers in Canada. Among the 186 participants in her study, Glenn sampled data from P-I interviews of 36 teachers who had also participated in the SET project. Using the Beliefs About Learning and Teaching Questionnaire (BLTQ; Glenn, 2007, 2018; Jordan, Washington, Schwartz, & Ahmed, 2005), Glenn found that incremental beliefs about ability were highly correlated with participant interventionist beliefs about disability. Though a significant correlation between epistemological beliefs, beliefs about disability, and teaching practices was not identified, Glenn's findings offered potential for further research into these relationships.

The research conducted by Jordan and colleagues suggests that one potential avenue for enhancing teachers' interactions and sense of responsibility for their students could be to shift teachers' beliefs from pathognomonic to interventionist beliefs about disability. At the heart of this issue is locating an approach that might facilitate such a shift, particularly since teacher beliefs may be difficult to change (Pajares, 1992; Richardson, 1996).

Universal Design for Learning

The practice of universal design for learning (UDL) is a promising element of today's education (Baglieri, Valle, Connor, & Gallagher, 2011; Katz & Sokal, 2016; Turnbull, Turnbull, Wehmeyer, & Shogren, 2016). UDL suggests that flexible learning environments facilitate access to the general education curriculum for all learners, including students with disabilities (Meyer, Rose, & Gordon, 2014). UDL has been recognized as a scientifically valid approach for instructional practice (Higher Education Opportunity Act, 2008).

UDL is characterized by three major principles and nine supporting guidelines reflecting flexibility in approaches to engaging students within the curriculum, providing information, and determining student learning. These three principles are recognized as (a) multiple means of engagement, (b) multiple means of representation, and (c) multiple means of action and expression. In its entirety, UDL is a framework that is grounded in brain research and the ways in which different functions of the neural networks interface with instructional and assessment approaches. Each of the three principles recognizes that no single approach will work for everyone, so the universality of these concepts is in their flexibility and intention to meet the needs of the broadest possible group of users (Meyer et al., 2014).

The literature on UDL suggests that it promotes access to the general education curriculum for students with disabilities (Abell, Jung, & Taylor, 2011; McGuire, Scott, & Shaw, 2006), to meet the needs of culturally and linguistically diverse learners (Chita-Tegmark, Gravel, Serpa, Domings, & Rose, 2012), to support Response To Intervention (RTI; Basham, Israel, Graden, Poth, & Winston, 2010), and to ground the development of inclusive lesson plans in pre-service teacher preparation (Courey, Tappe, Siker, & LePage, 2013; Spooner, Baker, Harris, Ahlgrim-Dezell, & Browder, 2007). UDL has also been framed as a means for reconceptualizing the least restrictive environment from one of exclusion to one of inclusion (Gabel, 2006), reforming the general education classroom to promote community and embrace differences (Baglieri, 2017), inviting critical reflection on the meaning of full inclusion (Routel, 2013), eliminating segregated systems for general and special education (Baglieri et al., 2011), and positioning students with disabilities at the centre of the curriculum, rather than as "failed exceptions to the rule" (Mitchell, Snyder, & Ware, 2014, p. 305).

Thus, UDL appears to hold great promise as an instructional framework for teaching students with and without disabilities. In fact, Capp (2017) conducted a meta-analysis of 18 empirical studies involving the application of UDL for improving learning processes and student learning outcomes. Capp's analysis supports the assertion that UDL can improve learning processes, though it has not yet been shown to improve student learning outcomes. Additionally, the intention of UDL to support all learners, not just those with disabilities, continues to be elusive; and its implementation is variable across schools, districts, and states (Ralabate et al., 2012; Vitelli, 2015). As Edyburn (2010) argued, UDL is a construct without a clear definition.

Still, the broad support for UDL as an educational framework and the identified relationship between beliefs about disability and teachers' interactions with students who have disabilities suggest the value of exploring the ways in which training in UDL for pre-service teachers might impact their beliefs about learning, teaching, and disability.

Further, in order to understand whether the way in which UDL was presented would differentially impact pre-service teachers' beliefs about learning, teaching, and disability, this study presented UDL through two discrete online modules, Module A and Module B. Each module reflected different epistemological beliefs about learning and teaching students with disabilities. Module A focused on disability as an innate and immutable characteristic in need of specialized instruction, suggesting entity and pathognomonic beliefs (Glenn, 2007). Module B emphasized that disability is constructed through an interaction between an individual's impairment and her environment (Wilson, 2017) and that the design of learning environments can allow for all students to become expert learners, reflecting incremental and interventionist beliefs (Myer et al., 2014). Therefore, this study addressed the research questions: (a) Is there a significant difference in pre-service teachers' beliefs about learning, teaching, and disability between participants who completed Module A and those who completed Module B? and (b) Is there a relationship between pre-service teachers' epistemological beliefs and their beliefs about disability?

Method

Before and after completing the study intervention, study participants completed the Beliefs About Learning, Teaching, and Disability Questionnaire (BLTDQ) adapted from Glenn's (2007) Beliefs About Learning and Teaching Questionnaire (BLTQ). Participants were randomly assigned to one of the two online instructional modules on UDL, Module A and Module B, which constituted the intervention for this study.

Intervention

All teacher candidates enrolled in sections of an introductory course in special education at a mid-sized, 4-year public university in the southwestern United States were required to complete one or the other of the two instructional modules. The introductory course is required of all teacher candidates in early childhood education, elementary education, and elementary and special education degree programs. The instructional modules supplanted the traditional classroom lecture on UDL, and were presumed to constitute the teacher candidates' first exposure to the topic of UDL in this course.

Theoretical grounding. The development of the intervention modules was premised on two underlying conceptions of disability. Module A situated disability as an innate characteristic of an individual requiring individualized interventions. This view of disability is widely accepted as the core of special education services and supports through the application of the individualized education program (Danforth, Taff, & Ferguson, 2006). This view of disability is sometimes referenced as a medical or deficit model of disability (Jordan et al., 1997; Wilson, 2017). By contrast, Module B framed disability as an important dimension of diversity and more a function of the learning environment than the student's impairment. These conceptions of disability have been variously called the social model of disability (Baglieri et al., 2011) or a social interpretation of disability (Wilson, 2017). Two outside reviewers evaluated the content of each module to determine their content validity. One reviewer was a former educator and administrator with special education experience and knowledge of UDL (Reviewer 1). The second reviewer had extensive knowledge of the social model of disability, UDL,

and the field of disability studies (Reviewer 2). Both reviewers were employees of the authors' institution. Initial feedback from Reviewer 1 suggested potential for greater differentiation between the content of the modules, while Reviewer 2 noted sufficient differentiation. In response to comments by Reviewer 1, additional content and references were added to Module A to emphasize the use of UDL as an accommodation specifically for students with disabilities within general education classrooms and to reinforce the concept of disability as a biological limitation, notwithstanding the more liberatory intent of UDL. No modifications were made to Module B. Descriptions and examples of module contents are described in Figure 1 and the following section.

Figure 1. *List of Videos Referenced Within Module A and Module B*

Module A	Module B
UDL At A Glance (4:36) https://www.youtube.com/watch?v=bDvKnY0g6e4	Inclusion, Belonging, and the Disability Revolution (23:02) https://www.youtube.com/watch?v=VAM9nh8WC-8
The Myth of Average (18:37) https://www.youtube.com/watch?v=4eBmyttcfU4	UDL At A Glance (4:36) https://www.youtube.com/watch?v=bDvKnY0g6e4
UDL Principles and Practices (6:35) https://www.youtube.com/watch?v=pGLTJw0GSxk	The Myth of Average (18:37) https://www.youtube.com/watch?v=4eBmyttcfU4
UDL Guidelines (6:20) https://www.youtube.com/watch?v=rfsx3DGpv5o	UDL Principles and Practices (6:35) (National Center on UD) https://www.youtube.com/watch?v=pGLTJw0GSxk
UDL Explained (3:26) (by Loudoun county Public Schools AT Team) https://www.youtube.com/watch?v=6P0s4qsLkt8	William Henderson Inclusive School (15:32) https://www.youtube.com/watch?v=NRR67_osT-Q
Universal Design for Learning—and Beyond (6:11) https://www.youtube.com/watch?v=mkBRm7-yJ30	Disabling Segregation: Dan Habib at TEDx (17:57) https://www.youtube.com/watch?v=izkN5vLbnw8
Scaffolding in Education (0:59) https://www.youtube.com/watch?v=ktXhIPUUPDs	Scaffolding in Education (0:59) https://www.youtube.com/watch?v=ktXhIPUUPDs
Teaching Matters: Scaffolding (5:13) (not captioned) https://www.youtube.com/watch?v=9gNjGD_W3dMm	Teaching Matters: Scaffolding (5:13) (not captioned) https://www.youtube.com/watch?v=9gNjGD_W3dM

Module contents. Following these theoretical underpinnings, each module was developed with a primary emphasis on the principles of UDL, adhering to CAST's UDL framework with fidelity. Each module presented UDL as an instructional approach that supports learners with different experiences, backgrounds, and abilities, including students with disabilities. Both modules used information from the course text, other text resources, online videos, and case studies to explore the definition, underlying premises, and applications of UDL. Figure 1 provides a list of videos used within each module to illustrate similarities and differences in module contents. Module A presented UDL as a means for accessing the general education curriculum by responding to the individual learning needs of students with disabilities (Meyer et al., 2014). More specifically, Module A reinforced the common perception that UDL is a specific strategy for meeting the needs of students with disabilities in the general education classroom or in more restrictive settings (Rabalate et al., 2012). Module A presented UDL through a view of disability as an innate and immutable characteristic requiring proprietary interventions. For example, the section on defining UDL included this from the course textbook: "Basically, UDL ensures that students with disabilities can access the general education curriculum via curriculum modifications achieved through technology and instruction (that is, pedagogy)' (Turnbull, Turnbull, Wehmeyer, & Shogren, 2014, p. 39)." Similarly, a discussion of the early application of UDL focused on CAST's use of technology to help students with disabilities overcome the barriers inherent in education and to "amplify areas of strength and support areas of weakness" (Meyer et al., 2014, p. 1).

Module B presented UDL as a means for creating inclusive classrooms by viewing disability as a social construction (Peters & Reid, 2009; Valle & Connor, 2011) and responsive to the design of learning environments. Module B comprised materials similar to those of Module A, but was supplemented with material from several sources that emphasized the relevance of UDL to creating inclusive learning spaces and communities of learners (Baglieri et al., 2011) or the application of UDL to support diverse learners in inclusive settings (Chita-Tegmark et al., 2012). For example, both Module A and Module B presented CAST's description of the three principles of UDL, but Module B also suggested the potential for UDL to "recognize and put a stop to educational practices and arrangements that position general and special educators as occupying different roles and responsibilities in the inclusive classroom/school' (Baglieri et al., p. 272)." Additionally, Module B emphasized the importance of students with disabilities as integral to the success of all learners within a community of learners (Meyer et al., 2014) and the potential for UDL to create democratic classrooms that value disability as part of diversity (Baglieri & Shapiro, 2012). Additionally, checks for understanding and case analyses in Module B focused more on the creation of classroom community than on UDL as an instructional adaptation, which was the focus of Module A.

Participants

Seventy-seven pre-service teachers completed the study. A significant majority of participants (78.8%) were either elementary education majors ($n = 32$, 41.6%) or elementary and special education majors ($n = 29$, 37.2%). Approximately three-fourths ($n = 58$, 75.3%) of participants were in their second year in college, with nearly an additional 20% ($n = 15$, 19.2%) of participants being in their third year.

An item on the BLTDQ questionnaire asked participants to indicate their level of prior experience with persons with disabilities. The distribution of participants across this factor tended to be much broader than for other demographic factors. The largest number of participants ($n = 29$, 37.7%) responded to the prompt “I know someone with a disability, and speak with them occasionally,” followed by “I have a family member with a disability (e.g., sister, father, daughter, grandmother)” ($n = 21$, 26.9%). No participants answered affirmatively to “I have no experience with a person with a disability, either in person or in media.”

Data Collection

The instrument used to answer the research questions was a questionnaire designed to rate pre-service teachers’ beliefs about disability, ability, teacher-controlled instruction, student-centred instruction, and attaining standards. This instrument, the Beliefs About Learning, Teaching, and Disability Questionnaire (BLTDQ) was made available before candidates completed the intervention. A second iteration of the BLTDQ was made available after candidate completion of the intervention. This pre-post design allowed for paired comparisons of participant beliefs before and after they completed Module A or Module B on UDL.

Beliefs About Learning, Teaching, and Disability Questionnaire. The BLTDQ was adapted from the Beliefs About Learning and Teaching Questionnaire (BLTQ; Glenn, 2007; Jordan et al., 2005). The original BLTQ (Glenn, 2007) consisted of 20 items across four principal components: (a) Teacher-Controlled Instruction (TCI, four items), (b) ability (E-I, six items), (c) Student-Centred Instruction (SCI, four items), and (d) Attaining Standards (AS, six items). The items related to ability were measured on a continuum from *entity* to *increment* (E-I) and are a component of epistemological beliefs (Dweck, 1999). Glenn (2007) reported a Cronbach’s alpha for the 20-item BLTQ of .840.

Pilot administration of the BLTDQ. The adapted BLTQ was the subject of a pilot study conducted prior to this study. The pilot instrument consisted of 53 items scored on a 6-point Likert-type scale. The pilot BLTDQ included items related to six dimensions: (a) beliefs about ability (seven items), (b) beliefs about teacher-controlled instruction (five items), (c) beliefs about student-centred instruction (six items), (d) beliefs about working with parents (four items), (e) beliefs about attaining standards (six items), and (f) beliefs about disability (25 items).

The items related to beliefs about disability were adapted from the pathognomonic-interventionist (P-I) dimension validated by Jordan et al. (1997) and Jordan and Stanovich (2003) and reported by Jordan et al. (2010). The P-I dimension was ascertained through a series of mixed-method studies involving interviews of approximately 100 classroom teachers (Jordan et al., 2009). The P-I items on the BLTDQ suggest beliefs along a continuum from those in which disability is seen as a fixed property of the individual (pathognomonic), to those in which disability is seen as relative to the individual’s interaction with their environment (interventionist). This dimension is of importance to the study, given its direct relationship with beliefs about disability.

Each rating on the pilot BLTDQ was scored to be consistent with the P-I construct. Thus, a rating of 1 reflected the pathognomonic end of the continuum while a rating of 6 reflected an interventionist belief, with ratings between 1 and 6 reflecting varying degrees along the continuum. Items were reverse scored, as appropriate, to be consistent with this structure.

Preliminary reliability analysis of the pilot instrument for all 53 items resulted in a Cronbach's alpha of .670. Although this reliability may be sufficient for preliminary or exploratory research (Meyers, Gamst, & Guarino, 2013), only 30 of 48 responses were complete (62.5%). As a result, the decision was made to limit the instrument to 30 items, removing the four items related to working with parents and only including the original 20 items from the BLTQ (Glenn, 2007) and 10 items from the P-I item set, due to their central role in this study. The ten items that constituted the final P-I set were drawn from the original 25 P-I items from the pilot administration of the BLTDQ. Corrected item total correlations were calculated, and the 10 P-I items with the highest reliability were chosen to supplement the original 20-item BLTQ.

Subsequent post hoc reliability analysis for the pilot administration with the original 20 items and the additional 10 P-I items resulted in a Cronbach's alpha of .731, a marginal improvement over the previous statistic of .670. The resulting 30-item BLTDQ constituted the final instrument for this study. Nine items on the final BLTDQ were reverse-scored to be consistent with the P-I construct (see Table 1).

Validity and reliability of the BLTDQ. The validity of the revised BLTDQ is grounded in the validity established by Glenn (2007) for the original BLTQ and the principal component analysis for the instrument. Additionally, a confirmatory factor analysis was considered for the BLTDQ to validate the factors identified in the original BLTQ, along with the added P-I subscale. However, the relatively small sample size ($n = 77$) precluded either a principal components analysis or confirmatory factor analysis (Field, 2013). Initial reliability for the administration of the BLTDQ in this study resulted in a Cronbach's alpha of .492. In accordance with recommendations by Cronbach (1951) and Field (2013), reliability calculations were completed for each subscale or factor of the instrument. A post hoc analysis was completed to determine individual subscale reliability values. The Attaining Standards subscale showed a Cronbach's alpha value of .199. However, the remaining four subscales yielded Cronbach's alpha values between .622 and .779 (P-I = .622; E-I = .743; SCI = .757; TCI = .779). A second post hoc analysis of reliability was conducted with the four items from the Attaining Standards subscale removed, yielding a revised Cronbach's alpha value of .780 for the BLTDQ. Additionally, statistically significant results were found for the mixed ANOVA, as described below. Statistical significance, itself, has potential for confirming the reliability of statistical findings (Gelman & Stern, 2006).

Results

Research Question 1

Is there a significant difference in pre-service teachers' beliefs about learning, teaching, and disability between participants who completed Module A and those who completed Module B?

To answer the first research question, a mixed ANOVA was used to determine whether there was a statistically significant mean change between the pre and post total scores on the BLTDQ for either module. Tests of normality indicated that the data were normally distributed and that the assumption of homogeneity of variances was not violated. The main effect of time showed a statistically significant change in beliefs about learning, teaching, and disability between the pre-survey and post-survey, $F(1, 76) = 62.009, p < .001$, partial $\eta^2 = .453$. These results suggest that approximately 45% (45.3%) of the change in pre-service teachers' beliefs about learning, teaching, and disability toward an interventionist perspective, as evidenced in this study, can be attributed to participating in an online training module in UDL, regardless of the way UDL was contextualized. Table 1 presents descriptive statistics, by item, for the BLTDQ pre and post administrations.

Table 1
Descriptive statistics for the BLTDQ, by Item, Pre and Post

Score	Item	Pre (N = 77)		Post (N = 77)	
		M	SD	M	SD
AS	13. The more students are concerned about grades, the more they learn.*	4.14	1.29	4.53	1.15
AS	31. Giving grades is a good strategy for getting students to work.*	3.29	1.17	3.81	1.15
AS	33. All of my students will do well, as long as they work hard.	4.91	0.96	4.91	0.92
AS	35. Students who produce correct answers have a good understanding of the core concepts.	3.43	1.27	3.40	1.07
EI	16. The ability to learn is something people have a certain amount of and there isn't much they can do to change it.*	4.84	1.18	5.08	1.12
EI	18. The ability to learn is something that remains fixed throughout life.*	4.04	1.66	4.18	1.68
EI	20. There isn't much I can do about how much ability I have in mathematics, science and language arts.*	4.90	1.12	5.06	1.07
EI	21. There will always be some students who simply don't get it no matter what I do.*	4.26	1.31	4.57	1.30
PI	10. I am responsible for teaching every student in my class, including those with disabilities.	5.82	0.53	5.84	0.43
PI	12. Teachers should plan to spend time with their students with learning disabilities while the rest of the class is working on a task.*	2.78	1.12	3.18	1.20
PI	14. In-class student work provides the most information about student progress.	3.92	0.96	3.87	1.24

Table 1, continued

PI	15. Observations and assessments of students with disabilities provide useful information for planning instruction for the entire class.	3.96	1.39	4.00	1.31
PI	17. I am confident that I will be able to get through to even the most disabled student.	4.68	1.08	4.97	1.10
PI	19. Teachers should spend as much time with their struggling students as they do with their typically achieving classmates.	4.55	1.40	4.78	1.33
PI	24. In fairness to other students, students who have a disability should not get grades higher than a minimum pass.*	5.09	1.27	5.07	1.44
PI	29. I will hold the same high expectations for all students in my class,	4.56	1.18	4.83	1.16
PI	34. Only students who are working on grade level curriculum should be in my class.*	4.69	1.21	5.05	1.06
PI	36. The learning patterns and history of a student who is not achieving need to be thoroughly evaluated by the teacher before the student is referred	4.53	1.21	4.66	1.23
SCI	23. To assess students' understanding of a core concept, it is important to observe and listen to them as they work.	5.26	0.82	5.13	1.07
SCI	25. Good teachers give students choices in their learning tasks.	4.66	1.01	5.16	1.19
SCI	26. In core subjects, students should construct their own examples.	4.39	1.15	4.79	0.98
SCI	27. Good instruction relates learning material to things students are interested in outside of school.	5.21	0.95	5.36	0.86
SCI	28. It doesn't matter whether students get the right or wrong answer as long as they understand the concepts inherent in the problem.	3.86	1.04	4.06	1.08
SCI	30. Concerns about getting the right answer are likely to interfere with concept development and learning.	4.56	1.01	4.51	1.21
TCI	7. Students should rely on the teacher to evaluate their work.	2.66	1.07	3.18	1.19
TCI	8. It is important for students to complete assignments exactly as the teacher planned.	2.70	1.18	3.84	1.24
TCI	9. In every class, I find students to whom I cannot teach core concepts.*	4.30	1.06	4.53	1.20
TCI	11. It is important for teachers, not students, to direct the flow of a lesson.	2.96	1.32	3.62	1.35
TCI	22. Students cannot be counted upon to evaluate their own work.	4.45	1.18	4.48	1.12
TCI	32. It is important for teachers to have control over lessons.	2.04	0.91	2.65	1.30

Note: Item numbering begins after six demographic items in the questionnaire not reported in this table. An (*) indicates an item that was reverse scored.

However, results of this analysis revealed that no main effect occurred for either Module A or Module B, $F(1, 76) = .007$, $p = .933$, partial $\eta^2 = 0$. In other words, the significance of the change in scores on the BLTDQ could not be attributed to either module specifically. Table 2 presents the average means and standard deviations of responses on the BLTDQ for both modules, pre- and post-survey.

Table 2
Descriptive Statistics for the BLTDQ, by Module, Pre-Post Survey

Module	Pre			Post		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Module A	37	125.88	9.12	37	132.89	11.59
Module B	40	125.03	8.15	40	133.36	12.56

A mixed ANOVA procedure was also used to determine whether there was a statistically significant mean change in beliefs between the pre and post scores on each of the subscales of the BLTDQ, as well as the three subscales combined. . Each mixed ANOVA procedure found a statistically significant main effect for time, ranging from teacher-controlled instruction, $F(1, 75) = 57.259$, $p < .001$, partial $\eta^2 = .433$, to student-centred instruction, $F(1, 75) = 5.937$, $p < .05$, partial $\eta^2 = .073$, and entity-increment, $F(1, 75) = 5.931$, $p < .05$, partial $\eta^2 = .073$. The main effect for time on the BLTDQ, overall, suggested that approximately 37% (37.1%) of the change in pre-service teachers' beliefs on the BLTDQ, toward an interventionist belief about disability, can be attributed to participation in a training module on UDL, $F(1, 75) = 44.270$, $p < .001$, partial $\eta^2 = .371$. The mixed ANOVA for the P-I subscale was of particular interest and suggested that approximately 18% (18.2%) of the change in pre-service teachers' beliefs about disability toward an interventionist perspective can be attributed to participating in a training module on UDL ($F(1, 75) = 16.727$, $p < .001$, partial $\eta^2 = .182$). Tables 3, 4, 5, and 6 present the average means and standard deviations of responses for the Teacher Controlled, P-I, Student Centred, and E-I subscales of the BLTDQ, respectively for both modules from the pre-survey to the post-survey.

Table 3
Descriptive Statistics for the TCI Subscale of the BLTDQ, by Module, Pre-Post Survey

Module	Pre			Post		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Module A	37	19.09	4.27	37	22.22	4.01
Module B	40	19.15	3.93	40	22.40	4.86

Table 4
Descriptive Statistics for the P-I subscale of the BLTDQ, by Module, Pre-Post Survey

Module	Pre			Post		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Module A	37	44.71	4.53	37	45.00	5.09
Module B	40	44.43	3.69	40	46.51	4.68

Table 5
Descriptive Statistics for the E-I subscale of the BLTDQ, by Module, Pre-Post Survey

Module	Pre			Post		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Module A	37	18.50	3.13	37	19.05	3.23
Module B	40	17.58	3.73	40	18.75	3.91

Table 6
Descriptive Statistics for the SCI subscale of the BLTDQ, by Module, Pre-Post Survey

Module	Pre			Post		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Module A	37	27.89	3.78	37	28.81	4.29
Module B	40	27.98	3.56	40	29.21	3.59

As with the mixed ANOVA for the overall BLTDQ, no interaction was found for either Module A or Module B within each of the instrument subscales. In other words, the mixed ANOVA procedure did not indicate that the change in scores for the Teacher Controlled, P-I, E-I, or Student Centred subscales of the BLTDQ could be attributed to either module specifically. The findings of this mixed ANOVA reflect an overall change in beliefs among participants toward an interventionist perspective for the BLTDQ and each of its subscales, following completion of either module on UDL.

Research Question 2

Is there a relationship between pre-service teachers' epistemological beliefs and their beliefs about disability?

A Pearson's product-moment correlation analysis was conducted to determine whether a significant relationship existed between participants' epistemological beliefs and their beliefs about disability. Epistemological beliefs were represented by a combination of average total scores for the Teacher Controlled, Student Centred, and E-I

items following the intervention. Participants' beliefs about disability were represented by average total scores on the P-I items following the intervention. Results of the correlation analysis (see Table 7) found no relationship between beliefs about disability and epistemological beliefs prior to the intervention ($R = 0.163$, $p = 0.157$). However, subsequent to participants completing the training on UDL, analyses indicated a moderate, positive significant correlation ($R = .478$, $p < .001$) between epistemological beliefs and beliefs about disability. Further, a correlation analysis was conducted to determine the relationship between beliefs about disability and the overall construct of the BLTDQ. The correlation between the average total scores on the P-I items prior to completing the modules and the average total scores on the BLTDQ demonstrated a moderate, positive correlation ($R = .616$, $p < .001$). Following the completion of the modules, the correlation between beliefs about disability and epistemological beliefs demonstrated a strong, positive correlation ($R = .774$, $p < .001$).

Table 7

***Pearson's Product Moment Correlations for
Demographic Factors, P-I scores, and Combined TCI, SCI, and E-I Scores***

	P-I (Pre)	P-I (Post)	BLTQ (Pre)	BLTQ (Post)	BLTDQ (Pre)	BLTDQ (Post)
P-I (Pre)	—	0.688 (0)***	0.163 (0.157)	0.250 (.028)*	0.616 (0)***	0.487 (0)***
P-I (Post)		—	0.314 (0.005)**	0.478 (0)***	0.616 (0)***	0.774 (0)***
BLTQ (Pre)			—	0.571 (0)***	0.845 (0)***	0.515 (0)***
BLTQ (Post)				—	0.617 (0)***	0.910 (0)***
BLTDQ (Pre)					—	0.706 (0)***
BLTDQ (Post)						—

Note. P-I (Pre) = average total scores for P-I items on pre-survey; P-I (Post) = average total scores for P-I items on post-survey; BLTQ (Pre) = average total scores for TCI, SCI, and E-I, combined, on the pre-survey; BLTQ (Post) = average total scores for TCI, SCI, and E-I, combined, on the post-survey; BLTDQ (Pre) = average total scores on the overall BLTDQ pre-survey; BLTDQ (Post) = average total scores on the overall BLTDQ post-survey. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

Discussion and Recommendations

Research Question One

Analysis of the results from the BLTDQ illustrated a statistically significant change in beliefs about learning, teaching, and disability pre- and post-intervention, as noted in the Results section. The mixed ANOVA found no interaction between time and intervention, however, suggesting that there was no significant difference in belief change between participants who completed Module A and those who completed Module

B. The interpretation of these findings supports the position that UDL is an important element of teacher preparation for meeting the needs of students with disabilities (Brownell, Sindelar, Kiely, & Danielson, 2010; Israel, Ribuffo, & Smith, 2014).

Jordan et al. (2010) reported that teacher practices supporting student-centred instruction and incremental beliefs in learning correlate with interventionist beliefs about disability. The flexibility that is characteristic of the UDL framework allows for student autonomy and self-regulation (Hall, Vue, Strangman, & Meyer, 2004). Similarly, the underlying premise of UDL suggests that “all participants in any educational environment should be learning, growing, and improving” (Meyer et al., 2014, p. 15), reflecting the inherent incremental view of learning in the UDL framework.

Training in UDL, as presented in Module A, appears to promote practices that support students with disabilities by adapting instruction to make the curriculum more usable. Such practices are undeniably helpful to students with disabilities, regardless of their placement in general or special education classrooms (Meyer et al., 2014). Numerous studies, however, have examined general and special education pre-service and in-service teachers’ beliefs about students with disabilities and inclusion (e.g., Cook & Cameron, 2010; Jordan et al., 2009; Jordan & Stanovich, 2003; McHatton & Parker, 2013). These studies suggest that placement in the general education classroom is not necessarily an impetus for facilitating more positive beliefs about disability. Similarly, no research to date has supported the premise that UDL, when applied as an approach to creating inclusive learning spaces that promote community and acceptance of difference, has a positive effect on beliefs about disability. The findings of this study offer a hopeful response to this gap in the literature by demonstrating the potential for such training to shift pre-service teachers’ beliefs about disability toward the interventionist end of the P-I continuum, though such changes may initially be marginal.

Thus, these findings support the work of Jordan and colleagues in the assertion that that training in UDL, regardless of its approach to supporting students with and without disabilities, may lead to more interventionist beliefs about learning, teaching, and disability. Recalling that interventionist beliefs are associated with teaching practices that are more supportive of students with disabilities in general education classrooms (Jordan et al., 2010; Jordan et al., 1997; Jordan & Stanovich, 2003), teacher preparation programs are called upon to consider the value of training in UDL as a more substantial element of their curricula. In the United States, while a high percentage of teacher preparation programs that receive federal Teacher Quality Enhancement grant funding do include training in UDL (Vitelli, 2015), the implications of this study highlight the value of training in UDL for all teacher preparation programs.

Research Question Two

Silverman (2007) found that high-level epistemological beliefs demonstrated a statistically significant correlation with beliefs about inclusion. The measure of beliefs about inclusion used in Silverman’s study, the Opinions Relative to Integration of Students with Disabilities scale (Antonak & Larrivee, 1995), did not directly address beliefs about disability, but did contain items relative to teachers’ academic and behavioural expectations of students with disabilities (Silverman, 2007). Similarly, Glenn

(2007) found that teachers who held more incremental beliefs about ability also tended to hold more interventionist beliefs about disability and their roles in working with students with disabilities. The moderate to strong relationships between pre-service teachers' beliefs about disability and epistemological beliefs identified in this study support and extend the findings of Silverman and of Glenn.

The positive relationship between high-level epistemological beliefs and interventionist beliefs about disability is noteworthy for teacher preparation programs, given its implication for teacher practice. A continuing challenge that teacher preparation programs face is the predominance among pre-service teachers of instructional beliefs that favour teacher-controlled instruction (Domovic, Vlasta, & Bouillet, 2017). Such beliefs tend to allow for little flexibility in the ways that students might engage with learning, suggesting an underlying notion that students' potential to learn is fixed. Teacher preparation programs might mitigate beliefs favouring teacher-controlled instruction by emphasizing the potential for UDL to reveal student ability in unexpected ways and to focus on complex and effortful notions of learning.

Limitations

These findings may lack generalizability due to the relatively small sample of pre-service teachers from a single institution in the southwestern United States. However, findings of this study are like those reported in other studies of pre-service teachers' beliefs (e.g., Ajuwon et al., 2012; Forlin & Chambers, 2011). For example, Ajuwon et al. reported that the attitudes of 67 pre-service teachers toward teaching students with disabilities was significantly more positive after completing an introductory special education course.

A second limitation was the limited duration of the intervention. The intervention in this study consisted of a short-term online training module. The short duration of the intervention may have muted the results of the data, reflecting the lack of interaction between the two intervention modules. However, studies by Gill, Ashton, and Algina (2004) and Kienhues, Bromme, and Stahl (2008) suggested that even short-term interventions can impact beliefs. Moreover, the lack of interaction between the different modules and pre-post survey results may reflect the sensitive nature of differences between the two ends of the P-I continuum. The differences between the content in Module A and Module B were designed to present the core elements of the UDL framework, as outlined by CAST, while emphasizing different philosophic and epistemological underpinnings. As noted by Pajares (1992) and Schraw (2013), measuring beliefs is difficult, and to do so, one must infer such beliefs (Bandura, 1977). A deeper differentiation between the content within the modules may have resulted in a more substantial interaction between the two modules.

Conclusion

Beliefs about ability and disability impact teachers' interactions with their students (Jordan et al., 2010). This study demonstrated the impact that training in UDL might have on pre-service teachers' beliefs toward an interventionist view of disability. Implications of this research highlight the important role that deliberate training in UDL can have in

preparing future educators for increasingly inclusive classrooms that honour students with disabilities as citizens in a democratic community of learners.

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