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Can participation in an online ASD training enhance attitudes toward inclusion, teaching self-Efficacy and ASD knowledge among preservice educators in diverse cultural contexts?

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ABSTRACT

As the number of students with Autism Spectrum Disorder (ASD) increases, so does the need for teacher training about inclusive education. We adapted an online training to provide pre-service teachers with strategies to integrate students with ASD into the classroom and evaluated it in two culturally diverse contexts. Students majoring in Education from the United States (Georgia; $n = 84$) and Canada (Québec; $n = 117$) completed the training and filled out pre- and post-training questionnaires. Initial attitudes toward inclusion were significantly more positive in Georgia than Québec. Participation in the training was associated with improved attitudes towards inclusion across both contexts and with improved ASD teaching self-efficacy and knowledge in Québec. Increased self-efficacy in Georgia was associated with a social desirability bias. This study demonstrates that a brief online training can promote positive attitudes toward inclusion across contexts.

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ASD; training; teacher; inclusion; cross-cultural

Introduction

In 1994, countries around the world were called to adopt as a matter of law or policy the principle of inclusive education, enrolling all children in regular schools unless there are compelling reasons for doing otherwise (UNESCO 1994, IX). Although policies supporting inclusion are now in place in most Westernised countries (e.g. Margret and Mazurek 2011), inclusive classrooms can result in both positive and negative outcomes for students with Autism Spectrum Disorder (ASD). On one hand, successful inclusion can provide many benefits to those students such as social and cognitive functioning improvements (Boutot and Bryant 2005; Eldar, Talmor, and Wolf-Zukerman 2010; Roberts and Simpson 2016). On the other hand, some students with ASD may face social isolation and/or bullying in inclusive settings and may make greater gains in

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special education placements that can specifically attend to their individual needs (Humphrey and Lewis 2008; Macintosh and Dissanayake 2006).

Adequate teacher training is consistently identified as a key factor impacting successful inclusion (Roberts and Simpson 2016); however, general education teachers often receive little to no training about ASD or evidence-based strategies to teach students with ASD in inclusive settings (Brock et al. 2014). Teachers around the world often report receiving insufficient training to help them successfully integrate students with ASD, into their classrooms (Njie 2017). Thus, the success of inclusion programmes may be limited by insufficient teacher training.

As the number of students identified as having ASD increases (Baio et al. 2018), so does the need for evidence-based training opportunities to help educators learn how to successfully integrate these students into mainstream classrooms. To begin to address this need, we developed and evaluated a brief, online ASD training designed to improve attitudes toward the inclusion of students with ASD, teacher self-efficacy in helping students with ASD learn, and knowledge about ASD among educators in training in two diverse cultural contexts.

Does support for inclusion vary across two cultural contexts?

We focused this initial evaluation of our training on two cultural contexts wherein issues with the successful inclusion of students with ASD have been specifically documented, Georgia (US) and Québec (Canada). In the US, the Individuals with Disabilities Education Act states that children with disabilities should be educated with non-disabled peers to the maximum extent feasible (Gordon 2006). Despite legislative support for inclusion, many children with disabilities, particularly children of colour, end up in segregated schools in Georgia (Aviv 2018). Additionally, special education teachers in Georgia report particularly low levels of training about ASD (Morrier, Hess, and Heflin 2011).

Educators throughout Canada also report insufficient training about ASD and inclusive education (e.g. Lindsay et al. 2013; Njie 2017). While the province of Québec (Canada) has adopted local policies favouring inclusion, there are no laws requiring inclusion of students with ASD within Québec. According to Poirier (2017), New Brunswick and Québec are the only Canadian provinces that do not have specific guidelines pertaining to the education of children with ASD. In 2017, the Québec Educational Inclusion Committee's report emphasised the need for further teacher training. Such trainings may be particularly helpful in regions such as Québec and Georgia where inclusion has had less success.

Prior trainings for educators of youth with ASD

Several studies examining ASD trainings for current or aspiring educators have been conducted but they vary in content and methodological rigour. A study conducted by Leblanc, Richardson, and Burns (2009) focused on increasing general knowledge about ASD and evidence-based Applied Behaviour Analysis (ABA) strategies. To the best of our knowledge, this was the only prior peer reviewed evaluation of an ASD training that focused on attitudes toward inclusion of students with ASD. The 200-minute-long in person

training was offered to 105 Canadian Education students in Ontario, Canada. The first of two sessions conveyed general information about ASD and ABA, while the second session covered evidence-based strategies to increase motivation, decrease anxiety, and teach social skills using ABA. Results demonstrated that participation in the training was associated with increased knowledge about ASD and ABA, greater comfort with teaching children with ASD, and a stronger belief that children with ASD can be integrated into mainstream classrooms. Leblanc's study was relatively comprehensive but no specific strategies to support inclusion were mentioned in the description of the training. In addition, assessment relied on a researcher developed instrument which included only one item assessing attitudes toward inclusion (i.e. examining the belief that most students with ASD can be integrated).

Chebli (2016) expanded upon this work by using a comprehensive measure to assess the potential effects of an ASD training on attitudes toward inclusion. This study examined a brief in-person ASD training offered to 92 general, special education teachers and trainees in Lebanon (Chebli 2016). Similar to the Leblanc, Richardson, and Burns (2009) study, the training topics focused on ASD knowledge and evidence-based ABA strategies to help children with ASD. Results of this study showed an increase in the teachers' ASD knowledge and self-efficacy after training. However, participation in the training was not associated with more favourable attitudes towards the inclusion of children with ASD and could be attributable to the continued focus on ASD facts and ABA treatment instead of on specific inclusion strategies.

This theme of focusing on specific approaches to treating ASD (most commonly ABA) and neglecting to highlight inclusion strategies is apparent in the vast majority of the peer-reviewed literature evaluating ASD trainings for educators, (e.g. Alexander, Ayres, and Smith 2015; Corona, Christodulu, and Rinaldi 2016). However, this focus on principles of ABA may not align with the needs of teachers in the general education context. In line with this, educators have reported that available trainings focus too much on tracking behaviours and not enough on strategies to help children with ASD learn (Lindsay et al. 2013). Only a few prior training studies have focused on the types of developmentally oriented and naturalistic interventions that may be particularly likely to scaffold social engagement, emotion regulation and learning (Lawton and Kasari 2012; Probst and Leppert 2008; Suhrheinrich 2011).

A primary goal of the current study was to develop a training reflecting a recent synthesis in the field of ASD treatment that melded the strengths of ABA with developmental approaches, or Naturalistic Developmental Behavioural Interventions (NDBI). The emphasis on multi-disciplinary approaches may be more effective than approaches derived from a single theoretical framework (Schreibman et al. 2015). NDBIs use natural contingencies and behavioural strategies to teach developmentally appropriate skills. In our training, we highlighted key principles of NDBIs such as: Shared control between educators and children (e.g. play-based activities like puppets) and natural reinforcement methods. Our training also provided an overview of the central ideas of Universal Design for Learning (UDL), and examples of key UDL techniques that can be used to support students with ASD and their peers (e.g. Social stories; Bublitz et al. 2015). A key principle of UDL is that the process of preparing educational materials for one diverse student (e.g. a child with ASD) will make the materials more accessible to other diverse students (e.g. non-native speakers; Burgstahler 2009). Given that

attempts at inclusion may fail people with ASD when provided by individuals without sufficient instruction in this domain (e.g. Mesibov and Shea 1996), the goal of this training was to provide educators with practical ways to adapt their educational practices to make them accessible to diverse students. Lastly, our training highlighted peer training, a naturalistic and efficient strategy that educators can use to promote inclusion. This strategy reduces the need for teacher generated prompts and has also been shown to be more effective than teacher directed social skills training (Kasari et al. 2012). In our training, we shared strategies that educators can use to train other students to help students with ASD access social opportunities in inclusive settings.

In sum, our brief training included up-to-date facts about ASD (Gillespie-Lynch et al. 2015), NDBI principles (Schreibman et al. 2015), information about UDL (Bublitz et al. 2015), and peer mediated social interventions (Kasari et al. 2012). Our study uniquely evaluated the success of our training in two cultures and two languages (French and English), to gauge generalizability. Teachers have expressed their concerns that calls for inclusion could add to their already overburdened workloads (Roberts and Simpson 2016) and have reported that they are more likely to seek out relatively brief and online trainings about ASD rather than more intensive university-based course sequences or coaching (e.g. Brock et al. 2014). Therefore, we focused on developing a relatively brief (~ one hour long) online training.

Methods

Intervention development

The online training used in this study was adapted from prior trainings (used in the Chebli 2016), study adapted from Gillespie-Lynch et al. (2015) and was supplemented with applied and up-to-date evidence-based information pertaining to: (a) NDBI's (Schreibman et al. 2015); (b) UDL strategies (Bublitz et al. 2015) and (c) Peer training to help peers teach students with ASD how to adapt socially (Kasari et al. 2012). The training included a 91 slide PowerPoint consisting of written text, illustrations, and videos to exemplify concepts and comprehension checks. After developing an initial draft of the training, the third author piloted the initial draft in New York City (NYC) with approximately 60 teachers, parents, paraprofessionals and school staff. Based on pilot feedback, we incorporated more hands-on practices and videos, as well as more information about ASD across the lifespan into the final version. The training and questionnaires were translated into French by the first author, who is bilingual in both French and English and is an ASD expert, in collaboration with a bilingual undergraduate psychology student, blind to study measures. After all materials had been translated into French, the fourth author, a French speaking ASD specialist, went through all materials to make sure they were understandable.

Participants

Georgia

We recruited participants from a large Southeastern University using a research pool within the College of Education. This research pool allows undergraduate students to

earn research credits to fulfil a course requirement. Eighty-four undergraduate participants completed the study. They had a mean age of 19.46 years; 86.9% of the sample identified as female and the majority of the sample was White (83.3%; Table 1).

Québec

In Québec, 117 participants completed the study through the Department of Education at two universities with French instruction. The lead author presented the opportunity to participate in the training to 16 different classrooms. In 10 of those classrooms, participants completed the project on their own time, but in the remaining six classrooms, students interested in participating completed the training during class time while regular instruction was paused. In return for participation, Canadian participants were entered into a drawing for a chance to win one of two \$50 MasterCard gift cards. The majority of the sample (91.5%) was female, approximately 83.6% of the sample was White and their mean age was 24.74 years.

Study procedures and measures

This study was approved by three University Institutional Review Boards (IRB). Participants completed an IRB approved consent form online before beginning the study. Participants completed all materials online, in English for the US sample and in French for the Canadian sample. Participants first completed a sociodemographic questionnaire developed by the study team and four questionnaires immediately before and after training. Outcome questionnaires evaluated teachers' attitudes toward inclusion, their sense of self efficacy, ASD knowledge and social desirability.

Teacher attitudes toward inclusion scale (TATIS)

The TATIS (Cullen 2010) has 14 items measured on a Likert scale designed to measure teacher's attitudes and beliefs about the inclusion of children with disabilities in the classroom. For this study, the TATIS was altered to focus specifically on students with ASD. The phrase 'student with mild to moderate disabilities' was replaced with 'autistic students' (pre-test $\alpha = .78$ for the Georgia and Québec sample and post-training alpha levels = .91 for the Georgia sample and .76 in Québec).

Table 1. Participant characteristics: Mean (SD) or percentages.

	Georgia <i>N</i> = 84	Québec <i>N</i> = 117	Significance
Age	19.46(1.40)	24.74(5.65)	$p < .001$
White	83.3%	83.6%	$p = 1.0$
Female	86.9%	91.5%	$p = .29$
Work Experience with Autism	17.9%	41.0%	$p < .001$
Mother Tongue			
French	0%	96.6%	$p < .001$
English	94.0%	0%	$p < .001$
Pre-test ASSET	59.71(25.47)	60.13(19.33)	$p = .90$
Pre-test TATIS	50.40(7.32)	46.39(7.32)	$p < .001$
Pre-test ASK-Q	40.58(4.11)	40.97(2.66)	$p = .85$
Social Desirability	17.52(5.98)	15.90(5.04)	$p = .04$

Autism stigma and knowledge questionnaire (ASK-Q)

The ASK-Q (Harrison et al. 2017) is comprised of 49 binary questions that evaluate an individual's understanding of ASD and potential stigma toward ASD. In the scale's original validation, each subscale was shown to have strong reliability with coefficients of .98 (Diagnosis), .95 (Etiology), .98 (Treatment), and .93 (Stigma). In the current study, Cronbach's alpha for the total score was moderate in the Georgia sample (pre-test: $\alpha = .70$; post-test: $\alpha = .80$) but low in the Québec sample (pre-test: $\alpha = .31$; post-test: $\alpha = .57$). This will be discussed in study limitations.

Autism self-efficacy scale for teachers (ASSET)

The ASSET (Ruble et al. 2013) has 30 items measured on a scale from 0 to 100 that ask teachers to report beliefs about their ability to teach students with ASD. Because of an error when entering the survey items for the Georgia sample, we were only able to compute ASSET scores based on the first 24 items. To obtain comparable results across countries, all analyses reported in the results section focus on composites derived from the first 24 items of the ASSET (Georgia: pre-test $\alpha = .99$; post-test $\alpha = .99$; Québec: pre-test $\alpha = .90$; post-tests $\alpha = .98$). The same pattern of change over time obtained with the 30 item and the 24-item scale in Québec was similar, so we focus on the 24-item version of the scale in the results to maintain consistent reporting across sites.

Marlowe-Crowne social desirability scale (SDS)

The SDS (Crowne and Marlowe 1960) is 33 'True' or 'False' items measuring the rater's desire for social approval. As this was not a study outcome, we opted to analyse and report this for the post-test time point only (Georgia $\alpha = .84$; Québec $\alpha = .77$).

Data analysis plan

Although 316 graduate and undergraduate students in Georgia and Québec began this study, 115 participants were dropped because of failure to complete post-test assessments or because of impossible responses on open ended questions. All analyses focus on the 201 students who completed the entire study. Given that autism knowledge was skewed at both pre- and post-test, a log-transformation was performed (Tabachnick and Fidell 2007). This transformation decreased skew but kurtosis remained heightened in the Québec data; therefore, we used non-parametric tests for all analyses involving the ASK-Q. In order to determine if the samples from each country differed on outcome variables, we ran chi-square tests for categorical variables and independent sample t-tests (or a Mann Whitney for the ASK-Q) for continuous variables. In order to examine potential associations between demographic variables, social desirability, and outcome variables at pre- and post-test, Pearson correlations (or Kendall's Tau for the ASK-Q) were calculated within each country. Given that the samples were not comparable, repeated measures general linear models (or Wilcoxon Signed-Rank tests for the ASK-Q) were calculated in each sample separately to determine if participation in the training was associated with changes in the dependent variable. In the single instance when social desirability was associated with post-training improvement (teaching self-efficacy in Georgia), we re-ran the analysis with social desirability as a covariate.

Due to the low internal consistency of the ASK-Q in Québec, McNemar analyses were used to examine potential changes in individual ASK-Q items in each sample. Given that the large number of analyses could increase type-1 error, the alpha level was set as .01 for all analyses.

Results

Comparisons of participants from Georgia and Québec

In both samples, most participants were White and female. Participants were younger in Georgia relative to Québec, with ages ranging from 18 to 27 years in Georgia and 19 to 50 years old in Québec. Most participants reported that their mother tongue was English in Georgia and French in Québec. Participants from Québec more frequently reported prior work experience with ASD than those from Georgia. Participants from Georgia reported more positive pre-test attitudes toward inclusion than participants from Québec. Pre-test ASD teaching self-efficacy and knowledge did not differ across samples. A trend toward heightened social desirability bias among participants in Georgia relative to those in Québec did not meet our cut-off for statistical significance (see [Table 1](#) for sample comparisons). In light of observed differences across samples, we decided to evaluate the training independently in each country.

Baseline correlations in Québec and Georgia

Likely due to the small and fairly homogenous samples in each country, most of the examined sample characteristics were not significantly correlated with pre-test attitudes toward inclusion, teaching self-efficacy, or ASD knowledge (Please see [Tables 2](#) and [3](#)). However, prior work experience with ASD was associated with heightened pre- and post-test teaching self-efficacy in Québec, where almost half of the sample reported prior experience working with individuals with ASD. Work experience was unrelated to teaching self-efficacy among participants from Georgia, most of whom had no past experience working with individuals with ASD. However, social desirability bias was associated with post-test teaching self-efficacy among participants in Georgia, suggesting that potential improvements in self-efficacy in Georgia might be attributable to social desirability bias. Social desirability was unrelated to any of the other variables, suggesting

Table 2. Correlations between pre-test and demographic measures in Québec ($N = 117$).

	1.	2.	3.	4.	5.	6.	7.	8.
1. Age								
2. Work Experience	-.08							
3. Social Desirability	.01	-.11						
4. ASK-Q Time 1	.15 [^]	.20 [^]	-.05					
5. TATIS Time 1	.09	-.03	-.09	-.08				
6. ASSET Time 1	.10	.30*	.11	.06	.06			
7. ASK-Q Time 2	.07	.07	-.07	.35**	-.10	.06		
8 TATIS Time 2	.10	-.01	-.17	-.06	.70**	.02	-.08	
9. ASSET Time 2	.05	.32**	.10	.04	-.02	.77**	.06	.12

Notes: Pearson's correlations were used except when analysing the ASK-Q, when the non-parametric Kendall's Tau was used.

[^]<.05; *<=.01; **<.001.

Table 3. Correlations between pre-test and demographic measures in Georgia ($N = 84$).

	1.	2.	3.	4.	5.	6.	7.	8.
1. Age								
2. Work Experience	-.01							
3. Social Desirability	.05	.01						
4. ASK-Q Time 1	.08	.10	.01					
5. TATIS Time 1	-.01	-.15	.03	-.02				
6. ASSET Time 1	-.14	.17	.16	.06	.18			
7. ASK-Q Time 2	.17 [^]	.07	.03	.51**	.04	.11		
8 TATIS Time 2	-.06	-.19	.03	.12	.70**	.22 [^]	.19 [^]	
9. ASSET Time 2	-.05	.08	.33*	.08	.19	.86**	.14	.37**

Notes: Pearson's correlations were used except when analysing the ASK-Q, when the non-parametric Kendall's Tau was used.

[^]<.05; *<=.01; **<.001.

that participants were generally responding honestly. Outcome variables demonstrated pre- to post-test reliability in both samples.

Examining potential changes associated with training

Repeated measures general linear models were conducted to evaluate if participation in the training was associated with increased ASD knowledge, attitudes towards inclusion and/or teaching self-efficacy in each sample separately. In the Georgia sample, attitudes towards inclusion improved with training (pre-test $M = 50.40$, $SD = 7.31$; post-test $M = 54.69$, $SD = 9.75$; $F(1, 83) = 31.66$, $p < .001$, $\eta p^2 = .28$). ASD teaching self-efficacy also appeared to improve between pre- ($M = 59.71$, $SD = 25.47$) and post-test assessments ($M = 69.35$, $SD = 26.92$; $F(1, 83) = 41.30$, $p < .001$, $\eta p^2 = .33$). As noted above, the only observed correlation between social desirability bias and an outcome variable indicated that post-test teaching self-efficacy was associated with social desirability bias in the Georgia sample. Therefore, we ran a repeated measures analysis of change in teaching self-efficacy with social desirability bias included as a covariate. This analysis revealed an interaction between change in self-efficacy and social desirability bias, $F(1, 82), 11.07$, $p = .001$, $\eta p^2 = .12$, and no main effect of change in self-efficacy, $p = .34$. Therefore, improvements in self-efficacy in Georgia were attributable to participants responding in a more socially desirable way following the training. An overall increase in ASD knowledge from pre- ($M = 40.58$, $SD = 4.11$) to post-test ($M = 40.96$, $SD = 5.34$; $Z = -1.76$, $p = .08$, $r = .14$) was *not* observed in Georgia.

In the Québec sample, participation in the training was associated with enhanced attitudes towards inclusion (pre-test: $M = 46.39$, $SD = 7.32$; post-test: $M = 48.64$, $SD = 6.97$; $F(1, 116) = 19.45$, $p < .001$, $\eta p^2 = .14$). ASD teaching self-efficacy, which was unrelated to social desirability bias in this sample, improved with training (pre-test: $M = 60.13$, $SD = 19.33$; post-test: $M = 69.32$, $SD = 19.03$; $F(1, 116) = 57.93$, $p < .001$, $\eta p^2 = .33$). ASD knowledge also improved from pre- ($M = 40.97$, $SD = 2.67$) to post-test ($M = 42.27$, $SD = 2.95$; $Z = -5.19$, $p < .001$, $r = .34$).

Discussion

Although teachers who understand ASD are central to their successful (Roberts and Simpson 2016), many report that they have not received sufficient training to successfully

educate children with ASD in inclusive classrooms (i.e. Eldar, Talmor, and Wolf-Zukerman 2010; Lindsay et al. 2013; Njie 2017). Prior research about ASD trainings for educators has generally focused on providing information about ASD and evidence-based supports for children with ASD, while neglecting to provide educators with strategies to promote inclusion. This study is the first, to our knowledge, to demonstrate that participation in a brief online ASD training emphasising specific strategies to promote the inclusion of children with ASD was associated with more positive educator attitudes in two culturally and linguistically diverse settings. Attitudes toward inclusion were more positive at pre-test in Georgia relative to Québec, suggesting that laws favouring inclusion may help shape more positive attitudes toward inclusion in a region. Additionally, this training was developed to have utility across cultural settings and is the first of our understanding available in French (the official language of Québec).

The current study expands upon Leblanc, Richardson, and Burns (2009) innovative research evaluating a 3.33 h long in-person ASD training for pre-service teachers by offering a shorter, more inclusion focused and more accessible training ideal for busy educators. Open-access, online ASD trainings that highlight recent research innovations for educators (e.g. NDBIs, UDL, and peer mentorship as a strategy to promote inclusion) may be particularly useful given that teachers report being more likely to seek out ASD trainings if they are brief and online (Brock et al. 2014).

Training related improvements in ASD teaching self-efficacy and ASD knowledge were also observed, although there were some limitations with the assessment of both of these constructs. Although improvements in ASD teaching self-efficacy were initially observed in both cultural contexts, follow-up analyses revealed that apparent improvements in ASD teaching self-efficacy among students in Georgia were attributable to social desirability bias. A trend toward heightened social desirability bias was also observed among participants in Georgia relative to those from Québec.

Prior studies about teaching self-efficacy, including research utilising the relatively new measure of ASD teaching self-efficacy (the ASSET; Ruble et al. 2013) used in the current study, have not typically evaluated possible associations between social desirability bias and teaching self-efficacy (e.g. Cerit 2010; Nie 2012). This is somewhat surprising given that pre-service teachers' self-efficacy is known to be influenced not only by one's own 'hands-on' learning experiences in the classroom (Housego 1992; Hoy and Woolfolk 1990), but also by vicarious experiences and verbal persuasion from others (Clark and Newberry 2019). This research suggests that teaching self-efficacy may be less stable among future educators with less personal experience with ASD, as was the case for most of the pre-service teachers from Georgia in this study. Only 18% of the participants from Georgia reported any prior experience working with people with ASD compared to 41% of the participants from Québec. Limited prior experience educating students with ASD may have caused a pre-existing tendency among participants in Georgia towards heightened susceptibility to the social desirability bias to influence their self-reported ASD teaching self-efficacy. Indeed, when completing the ASSET, participants are asked to respond about a particular student with ASD. Participants without prior experience working with people with ASD would be less likely to have a robust perception of a 'student with ASD' to ground their responses. Associations between social desirability bias and ASD teaching self-efficacy were apparent at post-test but not at pre-test among participants in Georgia, suggesting that perhaps the potentially hypothetical

‘student with ASD’ they were referring to in their post-test responses had been influenced by their perceptions of how the creators of the training viewed ASD. This interpretation is bolstered by the finding that teaching self-efficacy was associated at pre- and post-test with prior work experience with ASD, but not with social desirability bias, in Québec, where a larger portion of the sample had such experience. These findings suggest that the ASSET is more applicable (i.e. may provide an accurate measure of teaching self-efficacy that is rooted in one’s own experiences) for educators with prior experience teaching people with ASD than it is for people who are planning to teach people with ASD in the future. Findings also highlight the importance of assessing social desirability bias when conducting assessments of teaching self-efficacy more generally.

Improvements in overall ASD knowledge was observed among participants in Québec, but not among participants in Georgia. Given that the reliability of the French translated ASK-Q was very low, suggesting that it was not measuring a unitary construct in Québec, we conducted follow-up analyses of changes in specific knowledge items in each country. In both Québec and Georgia, participants’ understanding that ASD is more commonly diagnosed in males than females, that children with ASD may show reduced responsiveness to pointing, and that they may exhibit repetitive behaviours improved with training. No other improvements in ASD knowledge were observed in Georgia.

Participants in Québec became more aware following training that children with ASD can grow up to live independently, that they (may) need extra help to learn, that they do enjoy the presence of others, that ASD and intellectual disability are distinct, that ASD can be diagnosed as early as 18 months, and that the number of diagnosed cases of ASD has increased (Tables available from the first author). However, participants in Québec also appeared to learn some incorrect things from the training. Following training, they were more likely than they had been at pre-test to incorrectly report that ASD is usually associated with aggression, that it is a communication disorder and that it is not a brain-based disorder. Therefore, future adaptations of this training should provide clear evidence that ASD is not typically associated with aggression, should highlight differential diagnosis of ASD and other disorders, and should emphasise that ASD has a neurological basis. However, some of the counterintuitive changes on specific items of the ASK-Q observed in the Québec sample may have arisen due to a misalignment between the ASD knowledge measure used and the training itself. For example, participants may have been confused when we emphasised that communication difficulties are part of the diagnostic criteria for ASD in the training but then asked participants to recognise that ASD is distinct from a communication disorder in the knowledge assessment, without explaining that distinction in the training. Similarly, they may have taken the training’s point that there is no single cause of ASD to heart and been more likely following training to say that ASD is not a brain-based disorder, because they had learned that ASD has no single cause. Future researchers and clinicians seeking to assess improvements in ASD knowledge with training should ensure that the items in the ASD knowledge measure they use are easily interpretable by the general public and well-aligned with the information in the training. It would be particularly beneficial to develop knowledge measures that assess strengths as well as challenges associated with ASD and that take a lifespan approach to ASD, rather than focusing solely on children with ASD.

Although we did not conduct a systematic item by item analysis of the ASD teaching self-efficacy and attitudes toward inclusion measures, as they exhibited acceptable levels of reliability, perusal of participants' lowest mean scores on each of those measures revealed consistency in the constructs that participants in each region struggled with. The attitudes toward inclusion pre-test question that yielded the least positive attitudes toward inclusion in both cultural contexts was 'most or all special education classrooms that exclusively serve students with ASD should be eliminated'. Responses to this question improved with training.

Participants from Georgia and Québec originally reported the lowest mean scores on the following teaching self-efficacy items: Conducting an assessment of a student's developmental skills and describing implications for intervention based on students' characteristics of ASD. Both improved after training, although improvements in Georgia were likely attributable to social desirability bias. Those findings highlight the need to target teachers' roles in developmental skills' assessment and in the formulation of intervention goals.

Although the process of developing and evaluating a training to help teachers successfully teach students with ASD in inclusive settings has clear practical significance, this study has a number of limitations. We relied on a quasi-experimental design that lacked assessments of maintenance of change over time or generalisation across contexts. Indeed, research linking attitudes about teaching to behaviours in the classroom is generally lacking in prior research, including the present study. We are therefore left in the dark concerning whether attitudes towards inclusion translate into changed behaviours towards children with ASD in classroom settings. Future research should examine developmental changes in teaching self-efficacy and attitudes toward inclusion in relation to teachers' observed behaviours in the classroom and student outcomes, as attempts to ground measures assessing teachers' attitudes in objective outcomes remain relatively sparse in the research literature (Klassen et al. 2011). We would recommend replicating this study with teachers working in schools to evaluate generalisation effects. Based on participants' feedback, the inclusion of more applied videos and exercises could be helpful, particularly in the behavioural problems' section of the training. In order to retain participants' attention, the training could be divided into separate modules.

Although the ASK-Q is one of the few comprehensive ASD knowledge questionnaires, its psychometric properties before training were poor in the Québec sample ($\alpha = .31$) and at the lower end of acceptable in the Georgia sample ($\alpha = .70$). Our translation process was not sufficiently rigorous to ensure that the measures and training were functionally identical across contexts. Future cross-cultural work should include back translation by translators who are blind to the original measures and pilot feedback about the clarity of questions with stakeholders in specific cultural contexts (recommendations for effective translation are available in Bracken and Barona 1991; DuBay and Watson 2019). A linguist with ASD experience, blind to the measure back-translated the ASK-Q after we conducted this study and indicated that the French translation of the ASK-Q used in this study was generally accurate (personal communication, F. Picard, June, 9th 2019). However, she indicated that a number of the items could have been worded more clearly. She also felt that some items had no clear correct answer in either language. The ASK-Q also exhibited excessive kurtosis and skew in both contexts, which were correctable with transformations in the Georgia sample but not in the Québec sample. Due

to human error, the ASSET was missing its last six items in the survey in Georgia; complicating comparison efforts between the two samples.

Although both samples were pre-service teachers pursuing an education degree and were relatively similar in terms of gender distribution and ethnicity, they differed in terms of number of participants, age, work experience, and presumably, class standing. Therefore, comparisons across sites must be interpreted with caution. There were also issues with our demographic questions. We were unable to determine what proportion of the participants in Québec were graduate or undergraduate students due to lack of clarity in the wording of the question addressing class standing. Our question about prior work experience with people with ASD did not differentiate between teaching and other forms of work.

Conclusions

The current study demonstrates that participation in a relatively brief online ASD training that was designed to inform educators about strategies they can use to promote the successful inclusion of students with ASD was associated with immediate improvements in attitudes toward inclusion in two cultural contexts. Attitudes toward inclusion were also less positive at pre-test in Québec than in Georgia. Future cross-cultural research should evaluate the degree to which educators' attitudes about inclusion may be shaped by the laws in a given region. The training described in this report, which is available open-access in both French and English, could be used to improve attitudes toward inclusion in many parts of the world. Participation in this training was also associated with improved ASD knowledge and teaching self-efficacy in Québec, but not in Georgia. The challenges we faced assessing ASD knowledge and ASD teaching self-efficacy across cultural contexts may be informative for future researchers aiming to develop a comprehensive assessment approach to examine the impact of ASD trainings on current and aspiring educators in diverse cultural contexts.

Authors Contributions

SS initially conceived of adapting a training developed and evaluated with educators in Lebanon by Nidal Daou, Jennifer Chebli, Rita Obeid, Patricia Brooks, and Kristen Gillespie-Lynch. SS played the leading role in all aspects of the current study (e.g. conducting initial literature reviews, obtaining funding from the Laboratoire de Recherche sur les Familles d'enfants Autistes et leur Famille and the Consortium National de Recherche sur l'Intégration Sociale to support the project, developing the training and selecting assessment measures, translating materials into French, recruiting participants in Québec, running analyses and writing multiple drafts of this manuscript). YB, AJH's doctoral student, contributed substantially to setting up the training and assessments in Georgia, cleaning the data from Georgia, contributed to the writing of this manuscript, and organised the references. As one of SS's postdoctoral advisors on this project, KGL worked with SS to review relevant literature, developed the theoretical framework for the training, contributed very substantially to training development, piloted the training, developed the analytic approach, identified errors after initial data cleaning, conducted primary analyses, and contributed very substantially

to the writing of this manuscript by writing the final version of the introduction, results and discussion. As SS's other postdoctoral advisor on this project, NP helped with translating the training and assessments into French and recruitment in Quebec, as well as proofing the manuscript. AJH supervised recruitment, data collection and data cleaning in Georgia and contributed very substantially to revising the training, as well as to the writing of this manuscript.

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Nathalie Poirier is an Associate Professor. Her research projects pertain to the favouring of individuals with ASD's quality of life, training their teachers and supporting their parents.

Ashley Harrison is an Associate Professor. In terms of research, she is interested in identifying mechanisms that contribute to ASD service disparities. To this end, she is engaged in a range of projects assessing: (a) global discrepancies in ASD knowledge and stigma, (b) sociocultural variability in ASD symptom presentation such as attentional allocation, and (c) barriers to accessing early intervention and early childhood special education.

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