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# Evaluating the impact of an online autism training on changing employers' autism knowledge and commitment to inclusion in the workplace

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## Abstract

Employers' knowledge about autism can be a key barrier to autistic people obtaining employment. The current study evaluated the efficacy of an online autism training program, *Understanding Autism in the Workplace*, in changing employers' autism knowledge and commitment to inclusion in the workplace. Employers ( $N = 129$ ) from 22 organizations in the UK completed the training with an autistic ( $n = 45$ ) or non-autistic ( $n = 84$ ) trainer and completed surveys measuring (1) autism knowledge and (2) commitment to inclusion in the workplace (CIW), before and after the training. Results showed that at a group level, autism knowledge and CIW improved from before training to after training for all participants, for both the autistic and non-autistic trainer. This latter result may be attributable to the training being co-designed by autistic people. At an individual level, however, only a minority of participants (both with an autistic and non-autistic trainer) showed a significant increase in autism knowledge (10.1%) and CIW (5.8%), suggesting autism training was more effective for some participants than others. Autism training should not be the sole initiative to address barriers to employment for autistic people but should be part of a broader package of support for employers.

## Keywords

Autism, employment, training, employers, knowledge, inclusion

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In the UK, autistic<sup>1</sup> people's employment rate is 29% compared to 75.7% in the general population, the second lowest employment rate of all disability groups (Office for National Statistics, 2022, 2023). These statistics are broadly similar to those observed in other Western countries (e.g., Australian Bureau of Statistics, 2019; Roux et al., 2021; Zwicker et al., 2017). While these employment rates may be an underestimation due to there being undiagnosed or undisclosed autistic people in the workforce (Memmott, 2021, 2022), there is a notable gap between the 77% of autistic people who want to work, and the actual percentage who are employed (National Autistic Society, 2016). Further, autistic people in employment are often in low-paid jobs, below their level of education and capability (Hedley et al., 2017; Holwerda et al., 2015; Shattuck et al., 2012). Poor employment outcomes and a

lack of meaningful work can negatively affect an individual's mental and physical health (Chen et al., 2015; Hedley et al., 2019; Wanberg, 2012), inhibit opportunities for improved quality of life, socialization, and friendships

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(Flower et al., 2019; Hedley et al., 2018; Walsh et al., 2014), and cause financial hardship (Howlin, 2013). Poor employment outcomes also affect families more broadly, who have expressed concern about what will happen once they can no longer support their autistic relatives (Van Bourgondien et al., 2014).

### *Understanding autism*

A lack of understanding about autism can be a key barrier to employment for autistic people. Employers may be reluctant to hire autistic employees because of stigmatized attitudes around autism, beliefs that the costs outweigh the benefits (Graffam et al., 2002; Unger, 2002), and due to low self-efficacy in their ability to manage neurodivergent employees (Richards et al., 2019). For example, research has shown that employers may perceive autistic employees as not having the necessary skillset for a workplace, having poor productivity, and needing costly additional workplace adjustments, and time-consuming supervision and training (Cimera & Cowan, 2009; Ezerins et al., 2023; Hartnett et al., 2011). These attitudes persist despite research also demonstrating that autistic employees are an asset to organizations and that their employment does not incur additional costs (Scott et al., 2017).

Given the presence of stigmatized attitudes around autism, autistic people are faced with complex issues around disclosing their autism diagnosis/identity in the workplace, and to whom. For example, if an autistic individual does tell their employer and/or colleagues they are autistic, they may be subject to inaccurate, and therefore damaging, stereotypes about autism. Yet if they do not disclose, they may face a more challenging working environment with poor understanding and no workplace adjustments (Heasman & Gillespie, 2019; Romualdez et al., 2021). Surveying 283 clinically diagnosed autistic adults about their experiences of disclosure in the workplace, Romualdez, Heasman et al. (2021) showed that when considering disclosure, participants were most apprehensive about how people at work would perceive and behave toward them, and only a third of participants rated the impact of disclosing their autism at work positively. It is therefore evident that employer attitudes can play an influential role in how successful the outcomes of disclosure decisions are. Similarly, with respect to obtaining and retaining work, autistic people rate a lack of employer understanding about autism as the biggest barrier to gaining employment (Black et al., 2020).

Conversely, there is a body of evidence showing that people with better autism knowledge have more positive attitudes toward autistic people (Gillespie-Lynch et al., 2015, 2017; McMahon et al., 2021; Morrison et al., 2019; Sasson & Morrison, 2019). No research has yet assessed the relationship between employers' autism knowledge and their attitudes toward autistic employees, however,

the more general effects of better autism knowledge (outlined above) suggest that current, accurate information about autism could impact employers' perceptions about autistic people in the workplace. For example, knowing about areas that can be disproportionately challenging for autistic people, areas of relative strength, and ways to make accommodations for autistic people in the working environment could improve employers' self-efficacy and empower employers to feel more equipped to facilitate effective inclusion (Erickson et al., 2014; Hagner & Cooney, 2005; Scott et al., 2015).

### *Autism training*

It has been suggested that autism-specific training could address autism-specific stereotypes that are upheld and prevalent throughout society, often perpetuated by portrayals of autistic people in mainstream media (e.g., that autistic people have “super-human” skills such as photographic memory, that they are not sociable and have no emotions or empathy, and that autism exists on a spectrum from “a little bit” to “very” autistic; Mallipeddi et al., 2024).

Numerous studies have assessed the impact of autism training on autism knowledge in different groups of participants (although largely in non-autistic US college students). Gillespie-Lynch and colleagues (2015), for example, developed and evaluated online autism training (an asynchronous PowerPoint presentation with comprehension and engagement checks) for non-autistic university students in the US, which was designed to improve their acceptance of, and help them better understand and support, their autistic peers. Their results demonstrated a significant group-level change in average scores for autism knowledge and stigma, reflecting improved autism knowledge and reduced stigma. Using the same training materials, these group-level changes were replicated with other student populations, in different countries and cultures including Lebanon, Québec, and Japan (Gillespie-Lynch et al., 2022; Obeid et al., 2015; Saade et al., 2021; Someki et al., 2018). Beyond university students, online autism training has also been shown to have an impact on professional groups. For example, such training improved autism knowledge and autism screening and diagnosis rates in medical physicians (see review by Clarke & Fung, 2022), and improved post-secondary educators' autism knowledge and reduced stigma—changes that were maintained (albeit with some attenuation) one month after online training (Waisman et al., 2023). This training was also more effective at increasing autism knowledge compared to an active control training, or compared to groups who received no training (Ha et al., 2022; Jones et al., 2021).

Although research suggests that online autism training can be effective at improving autism knowledge and other outcome measures such as stigma, there is a dearth of literature that examines how autism training impacts behavioral applications of such knowledge. Pre- and post-training survey

studies could also include measures more closely related to behavior, such as intention to apply their knowledge and change specific behaviors in real-life settings.

Moreover, previous work has tended to draw conclusions from group-level analyses: comparing a group's average scores on various measures before and after training. Few studies have examined how outcome measures vary on an individual level. Of those that did, the focus was predominantly on factors associated with differences in baseline (i.e., pre-training) scores. For example, several studies have shown that variables such as country, gender, prior contact with autistic people, type of university major/degree, higher social dominance orientation, and less implicit bias are related to pre-training autism stigma and knowledge scores (Gillespie-Lynch et al., 2015, 2022; Obeid et al., 2015; Saade et al., 2021; Someki et al., 2018; Waisman et al., 2023). To our knowledge, no research has conducted individual-level analyses to examine the extent of change in scores for each participant pre- to post-training. We assert that individual-level analyses would provide a more meaningful picture of an online training's impact—clarifying whether a majority of participants show a significant change pre- to post-training, or whether any group-level differences are driven solely by changes experienced by a small number of participants. As such, in the present study, we evaluate the impact of an online autism training program on knowledge and commitment to inclusion, at both group- and individual-levels, for employers in the UK.

### Interventions for employers

There is limited evidence, at a group or individual-level, about whether interventions are effective at improving autism knowledge for employers, or whether they facilitate the inclusion of disabled people in the workplace (Erickson et al., 2014; Hedley et al., 2017). A small number of studies have used interviews and questionnaires to examine employers' perceptions of autistic employees, and to identify factors related to autism employment outcomes (for reviews see Hedley et al., 2017 and Rashid et al., 2017), but there is a dearth of literature directly assessing the efficacy of autism-specific interventions for employers. One study by Scott and colleagues (2018) assessed employers' attitudinal changes after using the *Integrated Employment Success Tool*; a manual for employers to improve their skills for hiring and supporting autistic colleagues in the workplace by increasing understanding about autism, highlighting strengths of autistic individuals, and outlining possible environmental challenges and workplace adjustments that could be made. However, after 12 weeks, there was no difference between those who did and did not use the manual in relation to their self-efficacy in implementing autism-specific supports, or their attitudes toward employees with a disability. A further study found that a behavioral

skills training program improved the skills of four staff members who provided job training for autistic young people (Palmen et al., 2010), but these participants were not employers. We therefore assert that there is a need for further research to assess and identify effective autism training resources specifically designed for employers.

### Autistic-input and expertise

It is essential to consider the role of autistic-input in autism-specific online training since prior contact with autistic people can improve attitudes and acceptance toward them (Gardiner & Iarocci, 2014; Gillespie-Lynch et al., 2017, 2019; Nevill & White, 2011; White et al., 2019). Drawing from this finding, autistic involvement may be a valuable component of effective autism training. Autistic involvement is especially important considering the ethical imperative to ensure autistic representation in autism-related topics to promote empowerment and ensure “nothing about us without us” (Charlton, 1998), and given autistic people's expertise about autism due to their lived experience (Gillespie-Lynch et al., 2017). Indeed, some effective online trainings were developed in collaboration with autistic people, and/or have included autistic people (e.g., autistic university students, PhD candidates, and academics) in the training via videos and/or reciting person-first narratives (Gillespie-Lynch et al., 2015; Jones et al., 2021; Waisman et al., 2023). Further, Gillespie-Lynch et al. (2022) found that autism training developed in a participatory way (i.e., working with autistic collaborators to edit content and add videos of topics) was more effective at improving autism knowledge and reducing stigma than training developed with non-autistic people. Qualitative feedback from this study's non-autistic university student participants suggested that the participatory training's effectiveness was due to having an (inter) personal element, better accessibility, and superior clarity of information.

### The current research and aims

In the current research, we conduct an initial evaluation of an online autism training program for employers, developed and delivered by the UK education and employment charity, *Ambitious about Autism*, as part of their supported employment initiative for autistic people aged 18 and over, *Employ Autism*. The *Employ Autism* program partners with businesses and organizations across the UK to provide supported, paid internships to autistic people, and resources and mentorship to partner employers, including autism training (see Ashworth et al., 2023). The novel autism training, *Understanding Autism in the Workplace*, was delivered by autistic and non-autistic “trainers” and removes the onus from the autistic individual to focus on mitigating issues in the working environment by increasing employers' autism

knowledge to dispel stereotypes and to promote and facilitate inclusion in the workplace.

Here, we assess whether having an autistic or non-autistic trainer affects post-training outcomes and we evaluate the impact of the training on employers' knowledge about autism and behavioral intentions for commitment to inclusion in the workplace overall (i.e., at a group level), and for each participant (i.e., at an individual level). First, we hypothesized that autism knowledge and commitment to inclusion in the workplace post-training scores would be significantly higher for participants with an autistic trainer compared to those with a non-autistic trainer, due to the benefits of autistic expertise. Second, drawing from previous findings on the impact of online training for university students (e.g., Gillespie-Lynch et al., 2015), we hypothesized that (2a) employers' knowledge about autism and (2b) commitment to inclusion in the workplace would improve from pre- to post-training at a group-level, but (2c) these increases may not be universal.

## Methods

### *Understanding autism in the workplace*

The autism training, *Understanding Autism in the Workplace*, was established in May 2020 as part of *Ambitious about Autism's* training and consultancy services, aimed at line managers and colleagues who were recruiting, employing, and mentoring autistic professionals with *Employ Autism*. Crucially, the training was developed in collaboration with autistic people, a neurodiversity consultancy group, and professionals with experience in autism training, to ensure it was comprehensive and accurate.

A detailed overview of the structure and content of the training is available in Supplemental Material A, and we provide an overview next. One "trainer" (an employee of *Ambitious about Autism*) led the training, discussion, and question and answer session online, supported by a 35-slide PowerPoint presentation that included text, images, and videos to help structure and illustrate points. The course focused on (1) providing relevant, accurate education about autism and neurodiversity to challenge stereotypes and (2) what employers could do to facilitate inclusion. Specifically, the training aimed to:

1. explore the concept of neurodiversity and how this relates to neurotypical and neurodivergent groups;
2. understand how communication skills, social interaction, social imagination, and sensory processing impact on autistic individuals' lives and working environment;
3. review intersectionality and the links with good working practice for autistic employees;
4. identify the talents and skill sets of autistic individuals;

5. explore the importance of identifying and implementing workplace adjustments to support autistic individuals; and
6. identify practical tips you can utilize within your day-to-day work practices to support an autistic individual.

The training was conducted on numerous days throughout the year to allow employees from different organizations who were partnered with *Employ Autism* to engage with the training at a suitable time in relation to when their internship started. The training was led by a non-autistic person until September 21, 2021, and after this date, the training was led by an autistic person.

### *Design*

The current study used a within-subjects quasi-experimental design to examine autism knowledge and commitment to inclusion in the workplace between two time points. There was a between-subject factor, *trainer*, to assess any differences in outcomes depending on whether the participants had an autistic or non-autistic person leading the training session. The independent variable was *time* (before and after autism training), and the dependent variables were (1) *autism knowledge scores* and (2) *commitment to inclusion in the workplace scores*.

### *Participants*

**Recruitment.** Participants were line managers and other employees of organizations partnered with *Employ Autism* that worked with or supported autistic young people in internships. *Ambitious about Autism* sent such individuals standardized information from the research team which stated *Employ Autism* was being independently evaluated, and invited them to be involved in the research. If participants volunteered to take part in the research, they provided informed consent before completing the pre-training survey.

**Characteristics.** One hundred and twenty-nine participants from 22 UK-based organizations completed both the pre- and post-training survey; 84 participants did the training with a non-autistic trainer and 45 did the training with an autistic trainer. Most participants (95.3%) worked full-time at the organizations with which they were affiliated, with 4.7% employed part-time. The most common age category was 26–35 years, and most participants were White British. The most common highest level of education was a bachelor's degree. All participants lived in the UK, but as the training was online, they were dispersed throughout the country, with the largest percentage based in London (see Table 1 for a further breakdown of participants' demographics).

The most common income range was £30,000–£39,999 and participants were from a range of organizations,

**Table 1.** Participants' demographics.

	Autistic trainer		Non-autistic trainer	
	n	%	n	%
Gender				
Man (including trans man)	15	33.33	32	38.10
Woman (including trans woman)	28	62.22	51	60.71
Prefer to self-describe	1	2.22	0	0.00
Prefer not to say	0	0.00	1	1.19
Missing	1	2.22	0	0.00
Age category				
18–25	1	2.22	12	14.286
26–35	13	28.89	34	40.476
36–45	18	40.00	16	19.048
46–55	8	17.78	17	20.238
56–65	4	8.89	5	5.952
Missing	1	2.22	0	0.000
Ethnicity				
White British	37	82.22	64	76.19
White Irish	1	2.22	3	3.57
Any other White background	2	4.44	9	10.71
White and Black Caribbean	0	0.00	1	1.19
Any other Mixed/Multiple ethnic background	1	2.22	1	1.19
Indian	1	2.22	2	2.38
Pakistani	0	0.00	1	1.19
Any other Asian background	0	0.00	1	1.19
African	0	0.00	1	1.19

(continued)

**Table 1.** Continued.

	Autistic trainer		Non-autistic trainer	
	n	%	n	%
Caribbean	2	4.44	0	0.00
Any other ethnic group	0	0.00	1	1.19
Missing	1	2.22	0	0.00
Highest level of education				
No formal qualifications	0	0.00	1	1.19
GNVQ	0	0.00	1	1.19
GCSEs	3	6.67	8	9.52
A/AS-level	4	8.89	10	11.91
BTEC	3	6.67	0	0.00
HND	3	6.67	2	2.38
Foundation Degree	1	2.22	3	3.57
Diploma of Higher Education	2	4.44	0	0.00
Bachelor's Degree	11	24.44	34	40.48
Post-Graduate Certificate	1	2.22	3	3.57
Post Graduate Diploma	2	4.44	0	0.00
Master's Degree	11	24.44	20	23.81
Doctorate	3	6.67	2	2.38
Missing	1	2.22	0	0.00
			100	
Region				
South East	13	28.89	15	17.86
London	15	33.33	36	42.86
North West	4	8.89	4	4.76
East of England	6	13.33	2	2.38

(continued)



Table 1. Continued.

	Autistic trainer		Non-autistic trainer	
	n	%	n	%
West Midlands	0	0.00	6	7.14
South West	2	4.44	8	9.52
Yorkshire and the Humber	1	2.22	3	3.57
East Midlands	0	0.00	2	2.38
North East	1	2.22	1	1.19
Scotland	1	2.22	4	4.76
Wales	1	2.22	3	3.57
Missing	1	2.22	0	0.00

including information technology, finance, marketing, recruitment, and (most commonly) departments in the public sector. See Supplemental Material B for a detailed breakdown of employment demographics by trainer type.

### Measures

**Autism Awareness scale.** To replicate previous research on the effect of autism training, the current study adapted Gillespie-Lynch and colleagues' (2015) Autism Awareness scale to assess autism knowledge.<sup>2</sup> Participants rated 12 statements (see Supplemental Material C for individual items) about autism on a 5-point Likert scale ranging from  $-2$  (*strongly disagree*) to  $2$  (*strongly agree*) to indicate to what extent they agreed with the accuracy of the statement. Items 2, 3, 5, 7, 9, 11, and 12 were reverse coded. Item 13, "People with autism have empathy,"<sup>3</sup> was removed from the current study due to the subjectivity of defining and measuring empathy, which confuses what would be considered an "accurate" answer to the item. Responses were summed to yield a composite autism knowledge score, which could range from  $-24$  through  $0$  to  $24$ . Higher scores indicate better knowledge about autism. Internal consistency of this adapted version of the Autism Awareness scale was good,  $\alpha = .80$ ; higher than the internal reliability established in Gillespie-Lynch et al.'s (2015) paper ( $\alpha = .56$ ), and in the paper establishing the psychometric properties of the original autism survey ( $\alpha = .66$ ; Campbell et al., 1996).

**Commitment to inclusion in the workplace questionnaire (CIWQ).** The CIWQ (Brosnan, 2021) was used to assess the impact of the training on participants' approach to

inclusion in the workplace. Participants indicated how committed their organization was to five areas of inclusion (see Supplemental Material D for items) on a 4-point Likert scale:  $0$  (*no commitments in this area*),  $1$  (*committed to making improvements in this area*),  $2$  (*confident in our inclusive practices in this area*) to  $3$  (*leading in this area, promoting inclusion in other organizations*). Responses were summed to yield a commitment to inclusion score, which ranged from  $0$  to  $15$ . Higher scores reflected greater commitment to inclusion in the workplace. Internal consistency of the CIWQ was good,  $\alpha = .90$ .

### Procedure

This research received ethical approval from the Department of Psychology and Human Development at IOE, UCL's Faculty of Education and Society (no ethics ID numbers are provided for PhD research projects at IOE). If the employers volunteered to participate in the research after being sent the information by Ambitious about Autism, they were directed to an online survey (powered by Qualtrics) to provide informed consent and demographic information. At the end of this survey, participants were issued with a randomly generated 10-digit ID to be used to complete the pre- and post-training surveys (also powered by Qualtrics) anonymously. Providing informed consent and completing the demographic information took approximately 10 min.

After completing the first informed consent and demographics survey, and before they took part in the autism training, participants completed another online survey comprising two measures: (1) the Autism Awareness scale and (2) the CIWQ. Next, participants engaged with the 3-h autism training via Zoom. Finally, participants completed a post-training survey that was identical to the pre-training survey. The pre- and post-training surveys each took approximately 5 minutes to complete.

### Data analysis

**Assumption checks.** Independent *t*-tests (or non-parametric equivalents) were used to determine the trainer groups' equivalency before the training and Levene's tests assessed each measure's homogeneity of variance at each timepoint.

**Group-level analysis.** Mixed ANOVAs with a repeated measures factor, time (pre- and post-training), and a between-subject factor, trainer (non-autistic or autistic), were used to compare participants' composite autism knowledge and commitment to inclusion in the workplace scores before and after training. Post hoc paired samples *t*-tests were used to identify any specific significant differences.

Where data were not normally distributed, non-parametric tests were used. Specifically, Wilcoxon Signed-Rank test with a Bonferroni adjusted alpha level of .004 per test (.05/12) to correct for type 1 error was used to assess changes in each

item of the Autism Awareness scale before and after training. Similarly, a Wilcoxon Signed-Rank test with a Bonferroni adjusted alpha level of .01 per test (.05/5) was used to assess changes in each item of the CIWQ before and after training.

#### Individual-level analysis

**Impact of autistic versus non-autistic trainer.** Chi-square analyses were used to determine whether there was a difference between the autistic versus non-autistic trainer groups in (1) the proportion of participants whose post-training scores increased, decreased, or stayed the same at an absolute level and (2) those that changed significantly according to the reliable change index.

**RCI analysis.** The RCI (Jacobson & Truax, 1991; Zahra et al., 2016; Zahra & Hedge, 2010) assessed the extent of change pre- to post-training on the autism knowledge and CIWQ measures at an individual level, its direction, and determined how much change was statistically reliable. The RCI was calculated using equation (1).

$$RCI = \frac{x_2 - x_1}{\sqrt{2(s\sqrt{1 - r_{xx}})^2}} \quad (1)$$

In equation (1),  $x_1$  and  $x_2$  represent an individual participants' score pre- and post-training, respectively, for either the autism knowledge or CIWQ measure,  $s$  is the standard deviation of all participants' scores pre-training, and  $r_{xx}$  indicates measure's test-retest reliability. When RCI scores are greater than 1.96, it is unlikely that the change in scores is because of the variability of the measure, and the change is considered statistically significant and reliable at the  $p < .05$  level.

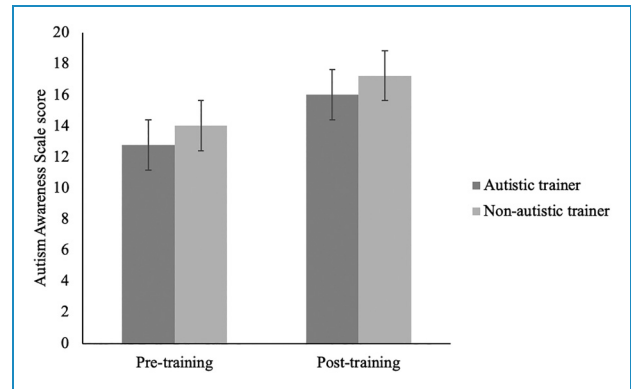
## Results

### Autism Awareness scale

There was no significant difference between the autistic and non-autistic trainer groups' pre-training autism awareness scores ( $t(127) = 1.38$ ,  $p = .17$ ,  $d = .26$ ) and Levene's test showed equality of variances for the pre- and post-scores (both  $ps < .71$ ).

**Group-level analysis of Autism Awareness scale.** Contrary to our first hypothesis regarding differences in outcomes based on trainer group, there was no significant interaction between time and trainer,  $F(1, 127) = .001$ ,  $p = .97$ ,  $\eta^2 = 2.05$  and no between subjects effect for trainer,  $F(1, 127) = 2.42$ ,  $p = .12$ ,  $\eta^2 = .01$  (see Figure 1 for average scores by time and trainer type).

However, in line with hypothesis 2a, there was a main effect for time,  $F(1, 127) = 67.31$ ,  $p < .001$ ,  $\eta^2 = .09$ . As there was no effect for whether participants had an autistic or non-autistic trainer, the participant groups were collapsed and a post hoc paired samples  $t$ -test showed autism



**Figure 1.** Average composite Autism Awareness scale scores before and after training by trainer type.

knowledge increased from pre-training ( $M = 13.59$ ,  $SE = 0.43$ , range: 0–23) to post-training ( $M = 16.82$ ,  $SE = 0.43$ , range: 1–24),  $t(128) = -8.2$ ,  $p < .001$ ,  $d = -.68$ . Follow-up tests to assess changes in specific questions of the Autism survey showed that knowledge increased from pre-training to post-training on 9 out of the 12 items (see Supplemental Material C).

#### Individual-level analysis of Autism Awareness scale

**Impact of autistic versus non-autistic trainer.** Chi-square analyses showed no significant differences between the autistic versus non-autistic trainer groups in the proportion of participants whose autism knowledge scores increased, decreased, or stayed the same at an absolute level, nor those that changed significantly according to the RCI (all  $ps > .05$ ), so the groups are presented together for subsequent individual-level analyses (see Supplemental Material E for full analyses).

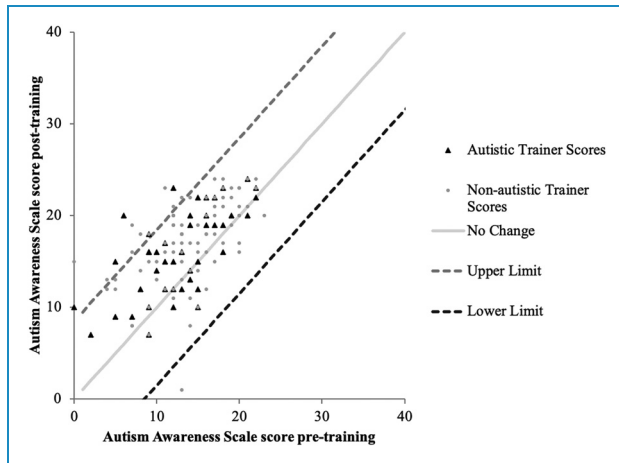
**RCI analysis.** Autism knowledge scores increased in 96 participants (74.42%) decreased in 21 participants (16.28%) and stayed the same in 12 participants (9.3%). In line with hypothesis 2c, the RCI showed that of 129 participants (both with an autistic and non-autistic trainer), 13 (10.1%) showed reliable increases in their autism knowledge scores pre- to post-training, and 1 participant showed a significant decrease in their score (see Figure 2).

### Commitment to inclusion in the workplace questionnaire (CIWQ)

There was no significant difference between the autistic and non-autistic trainer groups' pre-training CIWQ scores ( $z = 1, 858$ ,  $p = .182$ ,  $r = .15$ ), and Levene's test showed equality of variances for the pre- and post-scores (both  $ps < .78$ ).

**Group-level analysis of CIWQ.** Again, contrary to our first hypothesis regarding differences in outcomes based on





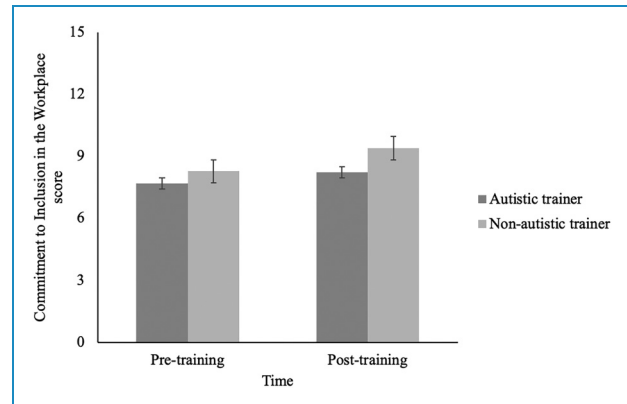
**Figure 2.** Scatterplot showing participants' pre- and post-training Autism Awareness scale scores. Note: In Figure 2, participants above the “No Change” line (i.e.,  $y=x$ ) showed an increase in scores and participants below this line showed a decrease in scores. Scores between the “Upper Limit” and “Lower Limit” lines show unreliable changes and scores above or below these lines show reliable changes (i.e.,  $RCI < 1.96$ ).

trainer group there was no significant interaction between time and trainer,  $F(1, 118) = 1.86$ ,  $p = .18$ ,  $\eta^2 = .002$ , and no between subjects effect for trainer,  $F(1, 118) = 2.69$ ,  $p = .10$ ,  $\eta^2 = .02$  (see Figure 3 for average scores by time and trainer type).

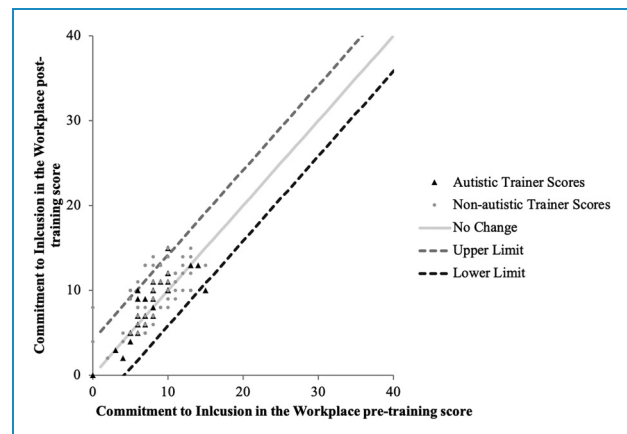
However, in line with hypothesis 2b, there was a main effect for time,  $F(1, 118) = 14.81$ ,  $p < .001$ ,  $\eta^2 = .02$ . As there was no effect for whether participants had an autistic or non-autistic trainer, participant groups were collapsed and a post hoc paired samples  $t$ -test showed commitment to inclusion in the workplace increased from pre-training ( $M = 8.12$ ,  $SE = 0.28$ , range: 0–15) to post-training ( $M = 8.95$ ,  $SE = 0.28$ , range: 0–15),  $t(119) = -4.50$ ,  $p < .001$ ,  $d = -.41$ . Follow-up tests to assess changes on individual items indicated that three areas of commitment to inclusion increased from pre- to post-training: (1) inclusive and accessible recruitment, (2) communicating vacancies, and (3) providing workplace adjustments (see Supplemental Material D).

#### Individual-level analysis of CIWQ

**Impact of autistic versus non-autistic trainer.** Chi-square analyses showed no significant differences between the autistic versus non-autistic trainer groups in the proportion of participants whose CIWQ scores increased, decreased, or stayed the same at an absolute level, nor those that changed significantly according to the RCI (all  $ps > .05$ ), so the groups are presented together for subsequent individual-level analyses (see Supplemental Material E for full analyses).



**Figure 3.** Average composite commitment to inclusion in the workplace scores before and after training by trainer type.



**Figure 4.** Scatterplot showing participants' pre- and post-training commitment to inclusion in the workplace scores. Note: In Figure 4, participants above the “No Change” line (i.e.,  $y=x$ ) showed an increase in scores and participants below this line showed a decrease in scores. Scores between the “Upper Limit” and “Lower Limit” lines show unreliable changes and scores above or below these lines show reliable changes (i.e.,  $RCI < 1.96$ ).

**RCI analysis.** Commitment to inclusion in the workplace scores increased in 55 participants (45.83%), decreased in 28 participants (23.33%), and stayed the same in 37 participants (30.83%). In line with hypothesis 2c, the RCI showed that of 120 participants (both with an autistic and non-autistic trainer), seven (5.8%) showed reliable increases in their CIWQ scores pre- to post-training, and one participant showed a significant decrease in their score (see Figure 4).

## Discussion

Our initial evaluation of an online autism training for employers demonstrated that, at a group level, autism knowledge and commitment to inclusion in the workplace improved post-training, irrespective of whether the trainer

was autistic or non-autistic. Analysis at an individual level, however, revealed that the change in scores for each measure was reliable only for a small minority of participants both with an autistic and non-autistic trainer. These findings represent the first evaluation of autism training for employers at a group and individual level and have conceptual implications for understanding the existing literature on autism training, and practical implications for supporting employment for autistic people.

Contrary to our first prediction, we found no significant differences in level of change for autism knowledge or commitment to inclusion in the workplace scores depending on whether participants had an autistic or non-autistic trainer: participants' scores in both the autistic and non-autistic trainer groups increased significantly post-training at a group level, and there were similar proportions of significant changes between trainer type at an individual level. While these findings appear to contradict the contact hypothesis (i.e., that quality interpersonal interaction with an autistic person may have facilitated better understanding), the mode of delivery (trainer presenting via video with attendees watching remotely) may have violated conditions for the contact hypothesis to be effectual because there would have been minimal interaction on an "equal" status (Paluck et al., 2019). Further, the lack of difference between trainer type may be because the training was co-designed by autistic people so the training's structure and content benefited from autistic input irrespective of whether the trainer was autistic or not, akin to Gillespie-Lynch et al.'s (2022) participatory autism training. Importantly, these findings do not negate the importance of autistic representation, which is vital. Indeed, autistic people's lived experience means they are best placed to teach others about autism and may encourage positive development and progressive ideology about autism (Gillespie-Lynch et al., 2017).

In line with our second prediction, the current study demonstrated group-level increases in employers' autism knowledge and commitment to inclusion in the workplace following online training. Larger effect sizes for the change in autism knowledge compared to changes in commitment to inclusion in the workplace are also consistent with previous literature (e.g., Gillespie-Lynch et al., 2015; Staniland & Byrne, 2013) that online training is more effective at changing knowledge compared to behavior-related constructs. Nevertheless, there were significant improvements in employers' commitment to inclusive recruitment, communicating vacancies, and providing workplace adjustments in the current study, perhaps because the training demonstrated or confirmed to the employers their self-efficacy and capacity to address these aspects of inclusion in the workplace.

However, individual-level analyses revealed that training did not yield reliable changes for autism knowledge and commitment to inclusion in the workplace for the majority of participants with an autistic or non-autistic

trainer. These findings provide the first evidence that reflects the extent to which autism training is effective for each participant, and challenge our existing understanding of the effectiveness of online training that has been based on research exclusively focused on group-level analyses (i.e., online autism training improves groups of participants' autism knowledge and stigma; Clarke & Fung, 2022; Gillespie-Lynch et al., 2015; Obeid et al., 2015; Saade et al., 2021; Someki et al., 2018; Waisman et al., 2023). Our individual-level findings suggest the aforementioned group-based research may overestimate the effectiveness of online autism training. Indeed, further scrutiny of their distribution statistics suggests they might have had similar variability in scores to the current study. For example, Gillespie-Lynch et al. (2022) reported large standard deviations for the average autism knowledge scores pre- ( $M = 22.4$ ;  $SD = 10.8$ ) and post-training ( $M = 31.6$ ;  $SD = 14.9$ ), suggesting variability in the changes demonstrated by individual participants. We assert that a new approach to evaluating the effectiveness of interventions, such as online autism training, is needed. Future research in this area should include individual-level analyses to determine the full extent of a training program's impact on different groups of people and investigate factors that influence individual score changes. This will be crucial to provide more reliable recommendations of an intervention's utility and to understand which audiences would benefit most from online training.

### Practical implications

Thus far, group-level evidence about autism training's effectiveness supports its wide use with various audiences. Contrarily, our evidence that online autism training is more effective for some participants than others suggests online autism training should be promoted and applied tentatively, with a clear caveat that it should not be relied upon as the only way to help employers support their autistic employees. Our findings support a holistic approach to address employment outcomes for autistic people. Indeed, prior research has suggested that diversity training is insufficient by itself (Alhejji et al., 2016) and that autism training is a "first step" (3533) for improving autism knowledge and related stigma (Obeid et al., 2015). Although employers' autism knowledge is an important foundational factor for good workplace inclusion, other aspects such as a suitable work environment and good person-job match are also key for employers to successfully support autistic employees (Dreaver et al., 2020).

Certainty, online training is an accessible, low-cost way to deliver autism training as it eliminates the cost of room hire and removes the need for trainers or delegates to travel, so has better geographical reach to engage more people (Clarke & Fung, 2022; Gillespie-Lynch et al., 2015). As such, online autism training for people such as

employers may still be worthwhile as a starting point to learn about creating more inclusive settings. Importantly, however, autism training for employers should be accompanied by a broader package of support initiatives by autistic people, or at the very least, with significant autistic input, to maximize employers' learning and appropriate application of knowledge in the workplace.

Encouragingly, the current training is delivered as supplemental to several other supports offered by Employ Autism, including tailored applied help in changing recruitment and onboarding practices, implementing workplace adjustments, and liaising between the autistic interns and employers to support good two-way understanding. It is crucial resources are also focused on these practical ways to support employers to apply behavior changes in the real world, and the current research provides key evidence used to justify Employ Autism's continued development.

### Limitations

While our findings offer insights into the outcomes of employer training, and how these are measured, there are several limitations that should be considered. First, there may be a sampling bias because, although there were similar proportions between trainer groups, our participants were mostly White women, which may limit the generalizability of our findings to a more diverse population. Similarly, the employers taking part had already committed to host internships linked with Ambitious about Autism, so the training may have had a different effect on a group of employers with less pre-existing commitment to neurodiversity and inclusion. In line with this, our participants' baseline autism knowledge was seen to be high, evidenced by an average total score of 13.59 on a scale from -24 through 0 to 24, as compared to previous research with university students whose baseline knowledge scores as assessed by different adaptations of the autism survey were 7.6 and 38.5 on scales from -26 to 26 and 17 to 55, respectively (Gillespie-Lynch et al., 2015; Tipton & Blacher, 2014). This explanation may also contribute to why there was a reliable change for a smaller proportion of participants, as high baseline autism knowledge scores may have created a ceiling effect which prevented a significant change in scores for some participants.

Second, this study did not measure how participants' autism knowledge and commitment to inclusion in the workplace translated to their practical behaviors. Self-reports of commitment to inclusion may be subject to inaccuracy and social desirability, whereby participants may have felt obligated to portray their organization as a welcoming and pleasant place to host an internship for an autistic young person. Moreover, training has limited scope to address other barriers, including (as noted above) employers' comfort in working with someone with a disability by quality or interpersonal interactions (e.g.,

Paluck et al., 2019), nor can it change employers' workloads that might influence their perceived self-efficacy to support autistic employees (e.g., Ezerins et al., 2023; Richards et al., 2019). As such, direct conclusions cannot be drawn about behavioral change toward autistic people in the workplace, despite the CIWQ offering a gauge about an organization's actions to promote inclusion in the workplace.

Third, there is much co-occurrence and overlap between areas of neurodivergence, so autism-specific training may not be ideal for comprehensively addressing inclusion in the workplace. Similarly, autism-specific programs can have unintended negative consequences for inclusive and diverse representations of autistic people in the workplace that may serve to sustain autism stigma (Doyle et al., 2022), so autism-specific initiatives should recognize the breadth of neurodiversity and their potential application beyond autism. The current training includes lessons about neurodiversity, but future iterations could include more focus on co-occurring conditions.

Finally, it should be acknowledged that as a quasi-experimental study with no control group, we cannot entirely attribute a change in scores to the training. It is possible there are potential alternative causes for the observed change over time that could not be controlled for in the current study design, such as the aforementioned issues of sampling bias and social desirability. Additionally, there may be testing effects due to a short time frame between the training and completing the post-training survey whereby participants were able to remember and regurgitate information more easily, which they may not have been able to do in the same way if the post-training survey was months after the training. To address these issues, future research should objectively corroborate self-reports of inclusion by evaluating each organization's inclusion policies or assessing how autistic colleagues perceived their inclusion in the workplace. Follow-up contact could also be made with the employers several months post-training to ascertain the training's sustained impact, and to see if their increased commitment to inclusion in the workplace had translated to practical changes in the workplace. It would also be informative to compare training outcomes for a group of employers who are not hosting internships for autistic people and may therefore be more representative of the wider UK workforce.

### Conclusion

This research represents, to our knowledge, the first evaluation of a co-designed online autism training initiative for employers, and the first concurrent group- and individual-level analysis of its effectiveness. While employers' autism knowledge and commitment to inclusion in the workplace improved for participants with an autistic and non-autistic trainer at a group level, our individual-level


findings showed that online autism training was effective for only a minority of participants. Our work therefore suggests reconsidering the existing research on autism training, and the adoption of a new conceptual approach to evaluation. This evidence also has important practical implications, whereby, in line with the literature calling for a holistic approach to supporting employment for autistic people, autism training should be promoted as supplemental to a broader package of applied support for employers and not relied upon as a sole initiative to improve autism knowledge and inclusion in the workplace. Further research is needed to determine what makes training effective at an individual level for subsets of participants, and to provide more reliable verification about its effectiveness by assessing behavioral change in the workplace.


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## Notes

1. This article uses identity-first (i.e., autistic person) as opposed to person-first (i.e., person with autism) to avoid perpetuating ableist ideologies (Bottema-Beutel et al., 2021) and because identity-first language is preferred by autistic activists (Sinclair, 1999). We acknowledge, however, the diverse views on this issue, even among autistic people (e.g., Buijsman et al., 2022).
2. While this measure is called the Autism 'Awareness' Scale, it actually assesses autism knowledge (i.e., the facts and information one holds about autism) rather than awareness (i.e., feelings or thoughts about autism). The Autism Awareness Scale was originally developed by Stone (1987), then adapted by Heidgerken et al. (2005)
3. Although the current study advocates for identity-first language, the Autism Awareness Scale uses person first language.

As such, person-first language is used only when referencing the Autism Awareness scale.

**Supplemental material:** Supplemental material for this article is available online.

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