Environmental interventions supporting autistic transition-age youth employability: A scoping review

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ABSTRACT

Background: Navigating the transition from school to work presents a challenge to many young people, and for autistic youth the challenge can be such that they never make it into employment. A greater understanding of interventions that support this important transition is needed.
Method: We conducted a scoping review of existing literature focusing on environmental interventions to support transition age youth preparing for employment. We categorized and analyzed the corpus of articles against the 'environmental factors' aspect of the International Classification of Functioning, Disability and Health (ICF) published by the World Health Organization.
Results: The five domains of environmental factors including the physical, social, and attitudinal environment in which people live offer an a priori framework to identify interventions that have been used globally to address autistic individuals' needs. We provide an overview of existing practices, specific interventions, strategies, processes, and resources used in schools, further and higher education institutions, and by employers that can account for improved vocational outcomes and/or successful transitions.
Conclusions: The employment potential of autistic students can be supported by a wide range of interventions many of which are not costly or difficult to implement. They fall into three broad types: remedial interventions that seek to change the autistic individual and how they [inter]act with their environment, adaptions that promote a more inclusive physical environment, and training and awareness raising interventions for others that promote change and support for autistic individuals in the social environment. We speculate on the insights to identify areas for further research.

1. Introduction

Employment is the defining activity of adulthood. It has been identified as a key factor in acquiring capabilities in many life domains and an important provider of personal meaning in many people's lives (Saunders & Nedelec, 2014). An editorial, focusing on neurodiversity, discusses the benefits to individuals in terms of self-esteem and links between the individual and society but also notes the potential economic benefits of including neurodivergent individuals in the workforce (Krzeminska et al., 2019). Broad acknowledgement of such benefits has initiated a burgeoning of new job opportunities suited to neurodivergent people (Roux et al.,

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2015). Nevertheless, the results of a large international survey on the barriers and facilitators to the employment of autistic people note large differences in employment rates worldwide in Australia (40.8%), the USA (38%) and Sweden (62%) respectively (Black et al., 2020). A recent United Kingdom (UK) Office for National Statistics (2020) report showed that only 22 per cent of autistic people were in full or part-time work, which is one in five autistic people in the UK. Of course, these figures are complex and it is crucial to acknowledge that although important in many cases seeking and maintaining employment is not for everyone. Many autistic people want to work but cannot, and others simply do not feel that employment is right for them.

For many autistic people, securing employment and keeping it is a massive challenge. Research focusing on young autistic people transitioning to sixth-form colleges, further education institutions, or employment, highlights the aspiration to achieve increased independence but also ambivalence about their future (Gaona et al., 2019). Investigating the extent to which academic and social skills predict postsecondary outcomes for autistic students, Nasamran et al. (2017) found that academic achievement was significantly related to postsecondary education and overall success and furthermore that social skills significantly predicted positive outcomes for autistic students for whom social interaction is challenging. This emphasises the importance of finding ways in which to understand and respond to the individual needs of autistic students who are keen to enter the workplace (Müller et al., 2022). Vincent (2020) suggests the need for policy transformation that is 'not simply rhetorical but is translated into improved practice across the higher education sector, including supported work placements, ongoing mentoring, better training for careers advisors, and engagement with employers to support them in making postgraduate recruitment processes more autism inclusive' (Vincent, 2020, p. 22). It is these grassroots, relatively low-cost, and easily adopted interventions which this paper aims to highlight. We acknowledge the assertion that multiple factors play a role in the transitional process/outcomes (Chen et al., 2018), however, our focus is specifically on environmental factors impacting the critical transition to function as part of the workforce.

2. Background

The International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001) (See Fig. 1) is a framework describing and organising information on functioning and disability. As a biopsychosocial model, it integrates medical and social models and uses function and disability as umbrella terms that include body functions, body structures, activities, and participation. As such, it captures the interaction between a health condition, and personal and environmental factors. The framework is based on several principles, and it is the final of these, the recognition of the importance of environmental influence on function, that provides the focus for this review.

The ICF's acknowledgement of a continuum between functioning and disability is particularly relevant in the context of environmental influences on function; it can be experienced to a greater or lesser extent and at different times in a person's life and alters according to their environment, activities (in this case education and employment), and the people with whom they interact. However, we recognise that environmental influences do not operate in isolation, that other aspects of the framework will be intricately linked, and that environmental factors can both facilitate and act as barriers to functioning (Bolte et al., 2021), ruling out causal relationships per se. Nevertheless, our intention was to understand which tangible environmental factors might account for the improvement in vocational outcomes for autistic individuals defining them as strategies, processes and resources available through schools, further and higher education and in work settings.

Responding to Baron-Cohen's (2017) call for a framework that does not pathologise neurodivergent individuals or focus disproportionately on what the person struggles with but gives equal attention to what the person can do, we suggest that the ICF can do this
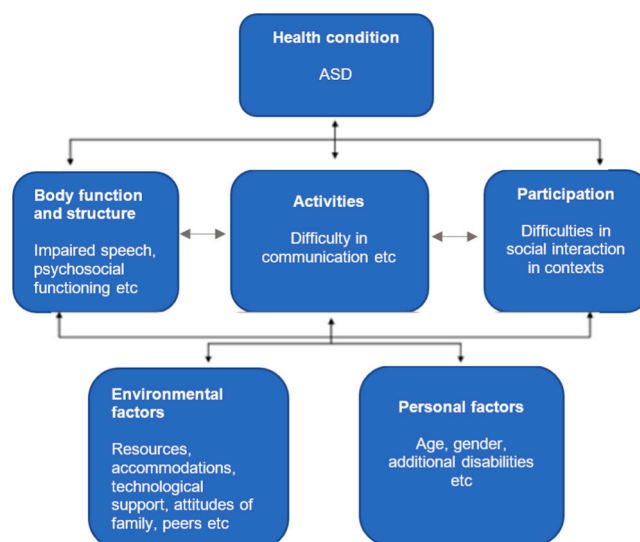

Fig. 1. International classification of Functioning Framework as applied to autism [adapted from WHO (2001)].

by synthesising body functions, body structures, activities and participation. Particularly relevant in the context of this article is the incorporation of environmental influences, which can be pivotal in constraining outcomes but also facilitatory such that individuals function not just well but demonstrate strengths that give them cognitive advantages (Cope and Remington, 2022).

Stucki et al. (2007) maintain that the ICF is valuable as a unifying interdisciplinary model that can bring together rehabilitation medicine, research and education to achieve improved understanding and outcomes. There is a growing body of research focused on the use of the ICF, although much has a clinical focus, for example, identifying people's health care, rehabilitation and support needs (Schiariti et al., 2018). However, the ICF has influenced legislation and social policy, education, employment and social welfare, and in Switzerland, it has been used in education to map disability-related information with information relevant to teaching and learning (Hollenweger, 2013). Scott et al.'s (2019) research focusing on the employment of autistic people uses the ICF in a similar way to us but includes adults with no upper age limit and at various stages of employment, whereas our sample focuses on young people and the transition to employment. They also include vocational rehabilitation programmes in their corpus. There is a wide spectrum of vocational rehabilitation approaches that vary by type and intensity that would have skewed attention in this review. For example, Lawler et al. (2009) describe one such comprehensive vocational rehabilitation service providing assessment and diagnosis, counseling, job search assistance, assistive technology, and on-the-job training. Typically, such programs are 'structured' interventions that depend on referral and offer extensive services involving teams of specialized, multidisciplinary rehabilitation personnel, both medical and non-medical. They are therefore resource intensive and costly, which shifts the focus from easily adopted and low-cost small-scale interventions that have been adopted in schools, further education colleges and by employers that aim to impact the environmental aspects of the transition to employment.

The ICF identifies five domains of environmental factors encompassing the physical, social, and attitudinal environment in which people live: (1) products and technology; (2) natural environment and human-made changes to the environment; (3) support and relationships; (4) attitudes; and (5) services, systems, and policies (WHO, 2001). These domains provided an a priori framework to categorise existing literature on the interventions used globally in addressing autistic individuals' needs with a few caveats. We took the products and technology domain to include tools such as iPads and personal digital assistants (PDA). These were not interventions designed to modify the environment per se but aided the person in terms of communication, time management etc. In addition, given that vocational programs were deemed to comprise substantial interventions that would significantly shift the scale, range and focus from relatively easy approaches that can be adopted by teachers and employers, we excluded vocational programs from this review. These studies would have fallen within the final domain of services, systems and policies and deserve their own review.

2.1. Method

A scoping review approach was selected for our study. It was deemed most relevant based on the suggestion that it is used when there is a need to scope and map the literature in a particular area to identify possible knowledge gaps and priorities for further research (Arksey and O'Malley, 2005). Comparing the application of scoping reviews and systematic reviews, Munn et al. (2018) suggest that a scoping review is preferred over a systematic review when identifying specific characteristics or concepts in studies and when mapping, reporting, or discussing them whereas a systematic review is the most valid approach if researchers aim to evaluate the meaningfulness, appropriateness, effectiveness, or feasibility of a particular practice or treatment. Both approaches involve identifying research questions and adopting rigorous and transparent methods to identify and analyze literature pertaining to the question[s].

However, we decided that a scoping review would better align with the purpose of examining the range and extent of literature
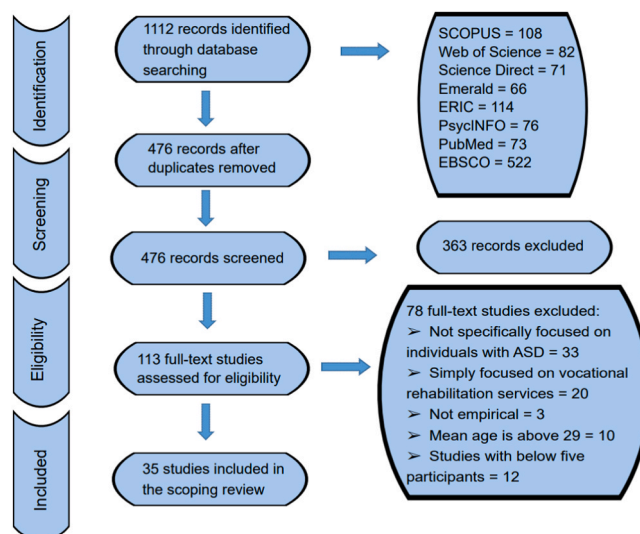

Fig. 2. PRISMA flowchart.

Table 1
Description of the studies included in the analysis.

Citation/ Country	Method	Participants	Age range	Type of Intervention	Outcomes – Outcome measures	Workplace-based	ICF Environment theme 1) products and technology; (2) natural environment and human-made changes to the environment; (3) support and relationships; (4) attitudes; and (5) services, systems, and policies
Athamanah and Cushing (2019), USA	Quasi-experimental (multiple baseline design)	n = 6	14–18	Peer-mediated intervention (PMI) in work-based learning (WB & PMI intervention (i.e., modelling, prompting & scaffolding) data collected 1–2 times per week over 16 weeks Treatment fidelity data	Increased independent engagement in vocational skills & social interactions; Improved quality of social interactions Observational measures	Yes	3
Baker-Ericzen et al. (2018), USA	Quasi-experimental (baseline and post-intervention)	n = 8	18–29 (X = 22,44)	Supported Employment, Comprehensive Cognitive Enhancement & Social Skills (SUCCESS) manualized integrated curriculum intervention. Participants split into 2 groups (4 in each group). SUCCESS implementation conducted within a specialized supported employment	Improved cognitive, social, and vocational outcomes that led to increased employment rates (more than doubled). Both participants and parents reported high rates of satisfaction and qualitatively described improvements in confidence, mood, cognitive skills, social skills, daily living skills, and vocational skills. Standardised outcome measures	Yes Supported employment	1, 5
Bouck et al. (2015), USA	NLTS-2 secondary data analysis	n = 4995	14–20	Secondary analysis of the National Longitudinal Transition Study-2 sought to understand the relationship between curriculum—functional versus non-functional—and seven measures of post-school outcomes for students with autism spectrum disorder.	No relationships were found between curriculum -functional or non-functional-& any of the seven post-school outcomes: living independently, ever attending post-secondary education, currently attending post-secondary education, ever employed, currently employed, earning above minimum wage & working full time. Descriptive outcome measures	N/A	3, 5
Bross et al. (2021), USA	Qualitative, interviews	n = 10 + parents or guardians	18–26 years	N/A	Four barriers to employment were identified: (a) logistics, (b) pre-employment challenges, (c) a disconnect between interests and job tasks, and (d) few on-the-job supports. Anecdotal outcomes measures	N/A	3
Chiang et al. (2013), USA	Secondary data analysis of NLTS2 – Waves 1–4	n = 830	13–16	N/A	The factors associated with participation in employment for autistic high school leavers Descriptive outcome measures	No	3

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Table 1 (*continued*)

Citation/ Country	Method	Participants	Age range	Type of Intervention	Outcomes – Outcome measures	Workplace-based	ICF Environment theme 1) products and technology; (2) natural environment and human-made changes to the environment; (3) support and relationships; (4) attitudes; and (5) services, systems, and policies
Cimera et al. (2013), USA	Secondary Data Analysis-RSA-911	n = 906	20.14–20.57 (average age range)	Two additional years of early (i.e., age 14 y) transition services	Higher employment rate; higher wages Descriptive outcome measures	No, Secondary and special education	5
Connor et al. (2020), USA	Quasi-experimental	n = 26	17–23, Mean age: 20.4	The Assistive Soft Skills and Employment Training (ASSET) program	Improved social cognition; social functioning & confidence; reduced anxiety & depressive symptoms Standardised outcome measures	No, High school and college	2, 3, 5
Gal et al. (2015), Israel	Quasi-experimental	n = 25	18–22, Mean age: 19.08	Professional training and employment placement (the Roim Rachok) program	Improved perception of quality of life & subjective well-being Standardised outcome measures	Yes	3, 5
Gaona et al. (2019), England	Qualitative semi-structured interviews	n = 12	16–19 (X = 16.4)	N/A	At the time of transition, youth with ASD want to become more independent, present ambivalent feelings about their future & acknowledge the relevance of support systems in their lives Anecdotal outcomes measures	N/A	3
Gentry et al. (2010), USA	Quasi-experimental	n = 22	14–18	Personal digital assistants (PDAs)	Improved independence in performing functional activities Descriptive outcome measures	No, high school	1, 3
Ghanouni and Raphael (2022), Canada	Qualitative, interviews	23 stakeholders, including 4 youths with ASD, 16 parents of individuals with ASD, and 3 service providers	Youth with ASD (X = 16), parents (X = 48), service providers (X = 35)	N/A	Advocating for opportunities and taking initiatives were found to help the autistic individuals obtain employment. Anecdotal outcomes measures	N/A	3, 4
Hatfield et al. (2017a), Australia	A quasi-randomized controlled trial	n = 94	Intervention group (Mean=14.8) and control groups (Mean=15.1)	A trial to determine the effectiveness of BOOST-A	BOOST-A enhances some career-readiness outcomes Standardised outcome measures	N/A	1, 3
Hatfield et al. (2017b), Australia	Quantitative, survey	n = 6	Adolescents in years 8–11 at school	Pilot of the BOOST-A, an online transition planning program for adolescents with autism.	Participants evaluated the BOOST-A as a feasible transition planning tool Standardised outcome measures	N/A	1, 3
Hatfield et al. (2018), Australia	Mixed-method, survey and interviews	n = 33 and their parents (n = 39)	Mean= 14.8 (adolescents)	Process evaluation of the BOOST-A	BOOST-A was evaluated as a beneficial intervention for transition planning Standardised outcome measures	N/A	1, 3
Hayes et al. (2015), USA	Randomized control trial	n = 15	17–18	VidCoach, a prototype video modeling application pre-loaded with seven interview videos	Improvement of job interview performance	No, senior year of high school	1

Table 1 (*continued*)

Citation/ Country	Method	Participants	Age range	Type of Intervention	Outcomes – Outcome measures	Workplace-based	ICF Environment theme 1) products and technology; (2) natural environment and human-made changes to the environment; (3) support and relationships; (4) attitudes; and (5) services, systems, and policies
					Observational outcome measures	or high school graduates	
Hedley et al. (2018), Australia	Qualitative methodology based on focus groups	n = 9 Family member (n = 6); Support staff (n = 7); &, co-workers (n = 6).	19–29 (X = 23.97)	Dandelion Program- join the initiative by AU Gov Department of Human Services & HP Enterprise providing employment opp. For people with ASD. Attended 4-week assessment and training program to be employed HPE software testing services within DHS.	Improved sense of purpose, personal independence, and social relationships Descriptive and anecdotal outcome measures	Yes	2, 3, 4
Lee et al. (2019), Australia	Qualitative design, grounded theory	n = 5, their parents (n = 6) and employers (n = 6)	15–18	An integrated work experience placement program	Improved workplace insight; recognized and realized potential; able to plan ahead. Anecdotal outcome measures	Yes	2, 3, 4, 5
Lynas (2014), Northern Ireland	Quasi-experimental	n = 72	16 + , exact range was not indicated	Project ABLE	Improved social skills and independence Descriptive and anecdotal outcome measures	Yes	3, 4, 5
McLaren et al. (2017), USA	Quasi-experimental	n = 5	19–28	Pilot: individual placement and support for ASD	Higher employment rate; higher wages Observational and anecdotal outcome measures	Yes	3, 4, 5
Morgan et al. (2014), USA	Randomized control trial	n = 28	18–36, Mean age: 24.5	a group-delivered intervention: interview skills curriculum (ISC)	Improved job interview performance Standardised outcome measures	No, higher or further education	2, 3, 5
Pillay et al. (2022), Australia	Longitudinal case study, mixed-method	n = 9	19–25 years (Mean=20)	N/A	A successful transition is positively associated with family and social support and negatively associated with low independence Standardised outcome measures	N/A	3
Richardson et al. (2019), USA	Qualitative design, multiple case study,	n = 7	20–26	Augmentative and alternative communication (AAC), Talking Mats (a lowtech, picture-based communication support)	Improved communication skills; secured employment Anecdotal outcome measures	Yes	1, 2, 3, 4
Rosen et al. (2017), Israel	Quantitative, survey (usability evaluation: case-control study)	n = 20	16–21	Computerized video modeling tool (Ready, Set, Work!)	Acquisition and improvement of social and vocational skills. App. discriminated between the work readiness skills of adolescents with ASD. The participants found the application relevant. Standardised outcome measures	No	1

Table 1 (*continued*)

Citation/ Country	Method	Participants	Age range	Type of Intervention	Outcomes – Outcome measures	Workplace-based	**ICF Environment theme** 1) products and technology; (2) natural environment and human-made changes to the environment; (3) support and relationships; (4) attitudes; and (5) services, systems, and policies
Ruble et al. (2019), USA	Secondary data analysis	n = 20 + 20 Special ed. teachers, 20 parents	17–20 (X = 17.2)	Collaborative Model for Promoting Competence & Success for transition (COMPASS-T) manualized students centered consultation intervention.	Parent activation &student externalizing behavior correlated with employment. Families &students, rather than school personnel, were the primary persons in charge & in control of the implementation of post-secondary plans. Standardised outcome measures	No	3
Smith et al. (2014), USA	Randomized control trial	n = 26	18–31, Mean age: 24.2	Virtual reality job interview training (VR-JIT)	Improved job interview performance & self-confidence Standardised outcome measures	No, Higher or further education	1
Smith et al. (2015), USA	Randomized control trial	n = 26	18–31 Mean age: 23.1 (control group), 25.0 (VR group)	Virtual reality job interview training (VR-JIT)	Improved interviewing skills Standardised outcome measures	No, Higher and further education	1
Smith et al. (2020), USA	Quantitative, survey (community-engaged, three-stage approach)	n = 24	16–21 (ASD)	Virtual reality job interview training (VR-JIT) adaptation for youth with ASD	Took the views of youth & stakeholders & adapted a VR-JIT model for the youth with ASD Descriptive outcome measures	No	1
Smith et al. (2021), USA	A randomized controlled feasibility and effectiveness trial	n = 71	16–26 years	To evaluate the feasibility and effectiveness of the Virtual Interview Training for Transition Age Youth	Participants receiving the Virtual Interview Training for Transition Age Youth had lower job interview anxiety, better job interview skills and higher access to jobs. Standardised outcome measures	No	1
Strickland et al. (2013), USA	Randomized control trial	n = 22	16–19	An internet accessed training program (JobTIPS) that included Theory of Mind-based guidance, video models, visual supports, &virtual reality practice sessions	Improved verbal skills for job interviews Standardised outcome measures	No	1, 3
Sung et al. (2019), USA	Quasi-experimental	n = 26	18–25, Mean age: 20.5	The Assistive Soft Skills and Employment Training (ASSET) program	Improved work-related social skills; social functioning; social/ empathy; self-efficacy Standardised outcome measures	No, High school, post-secondary education	2, 3, 5
Wehman et al. (2014), USA	Randomized control trial	n = 40	18–21 years	Project SEARCH with ASD supports	Higher employment rate; higher wages Standardised outcome measures	Yes	2, 3, 4, 5
Wehman et al. (2017), USA	Randomized control trial	n = 49	18–21 years	Project SEARCH with ASD supports	Higher employment and retention rates; higher wages Standardised outcome measures	Yes	2, 3, 4, 5

Table 1 (*continued*)

Citation/ Country	Method	Participants	Age range	Type of Intervention	Outcomes – Outcome measures	Workplace-based	ICF Environment theme 1) products and technology; (2) natural environment and human-made changes to the environment; (3) support and relationships; (4) attitudes; and (5) services, systems, and policies
Wehman et al. (2019), USA	Randomized control trial	n = 156	18–21 years	Project SEARCH with ASD supports	Higher employment rate; higher wages Standardised outcome measures	Yes	2, 3, 4, 5
Whittenburg et al. (2020), USA	Randomized control trial	n = 14	18–22 years	Project SEARCH with ASD supports	Higher employment rate Descriptive outcome measures	Yes	2, 3, 4, 5
Wong et al. (2021), USA	NLTS-2 secondary data analysis	n = 70	The average age at Wave-1 was 15	N/A	Parent participation in education have a positive influence on the employment outcomes of the youth with ASD through the mediation effects of school-based transition supports and academic performance. Descriptive outcome measures	N/A	3, 5

8

regarding the employment of youth with ASD, using the ICF framework to categorize the findings. In accordance with the review methodology, our first step was to identify our research questions, which were as follows:

1) What types of interventions (strategies, processes, and resources) are adopted in schools and further and higher education to facilitate the transition to employment for autistic students?
2) What interventions are in effect in work settings (strategies, processes, and resources) to support potential and new autistic employees in accessing and sustaining employment?
3) What interventions are used to improve vocational outcomes for autistic individuals across the ICF's environmental domains?

2.1.1. Literature search procedure and analysis

The following electronic databases were used to conduct the initial literature: EBSCO (Academic Search Premier, Education Research Complete, CINAHL, E Journals, MEDLINE Complete), Emerald, ERIC, PsycINFO, PubMed, Science Direct, SCOPUS, and Web of Science. The terms "transition to work, to-employment, -to-workplace, and –to-workforce" were used with Boolean Operator 'AND' in conjunction with the possible versions of autism (ASD). It is not uncommon for ASD to occur in tandem with other conditions, therefore we have included studies where autism is the primary condition, even where other conditions were present, but have discounted studies with a secondary focus on autism.

The inclusion criteria comprised: (1) focusing on ASD as the primary condition; (2) referring to an intervention: strategies, processes, and resources (i.e., technological and non-technological); (3) empirical studies published in peer-reviewed journals rather than theoretical ones; (4) written in English; (5) including a methodology and scientific background; (6) the study sample included autistic individuals between 15 and 29 years of age as longitudinal studies were not uncommon and the International Labour Organisation (ILO) defines up to 29 years of age as 'young'; (7) published between 2009 and 13th June 2022; (8) including at least five or more research participants in the sample.

Articles that were excluded from the corpus were those focusing on vocational rehabilitation (as a structural intervention based on a comprehensive service), articles simply reporting the attitudes of various stakeholders, and case studies with below five participants. Where programs are delivered in, for example, a further education setting, for instance, the laboratory-based virtual reality job interview training simulation featured in studies by Smith et al., (2014, 2015, 2020, 2021), these were included. Two researchers worked independently to conduct the initial review of the titles and abstracts, screening against inclusion/exclusion criteria. Full texts were screened where uncertainties occurred. Resultant selections were shared, and any discrepancies were resolved through discussion. A third researcher reviewed the agreed corpus under the ICF environmental factors categories. The nature of many interventions meant that most studies could be assigned to more than a single domain.

In this study, the "products and technology" domain includes the tools, products, or technologies utilised to facilitate the process of transition to work for autistic individuals. The "natural environment and human-made changes to the environment" theme represents the changes to routines to facilitate this process. The "support and relationship" theme describes the physical and/or emotional support by the people around autistic individuals to assist them through the transition. The "attitudes" theme illustrates interventions that have altered other people's dispositions, perceptions, or biases and the "services, systems, and policies" theme shows the services and programs in place to assist autistic youths through the transition process. A PRISMA flowchart (Moher et al., 2009) is used to detail the steps followed in deciding on the included/excluded studies through different phases as a means of enhancing the transparency of the approach (Fig. 2).

3. Results

There are 35 studies in the final corpus of the scoping review. Samples are comprised of autistic youth (35 articles), but 6 studies include data from other stakeholders (teachers, parents, employers, job coaches, mentors, support staff, or coworkers). Articles are predominantly from the USA (24 articles), followed by Australia (6), Israel (2), Canada (1), England (1), Northern Ireland (1). Research approaches vary from randomised control trials (10), quasi-experimental (9), secondary data analysis (5), qualitative (6), quantitative surveys (3), longitudinal design (1), and mixed method design (1) (See Table 1).

In line with Scott et al.'s (2019) findings, the current review reveals that with the exception of a few studies (e.g., Baker-Ericzen et al., 2018; Gal et al., 2015; Gaona et al., 2019; Morgan et al., 2014; Smith et al., 2014, 2015) the literature lacks reliable and valid tools to measure autistic young adults' employment outcomes.

The type of outcome measures used in each study is included in the "outcomes" column of Table 1.

Almost half of the studies (n = 17) in the corpus used descriptive, observational or anecdotal outcome measures (7 descriptive, 5 anecdotal, 2 observational, 2 descriptive and anecdotal, and 1 observational and anecdotal). In those studies, self-reports of employees and/or observations and anecdotes of employers, parents, and researchers were used to supplement the descriptive information about the required support, wages, working hours, and job type.

The other 18 studies in the corpus utilized standardized measures, mostly to measure social and intellectual abilities and to corroborate the ASD diagnosis. The measures were diverse, including, for example, the Autism Diagnostic Interview, Delis-Kaplan Executive Functioning System, Wechsler Adult Intelligence Scales, The Behavior Rating Inventory of Executive Function, Social Skills Performance Assessment, Functional Daily Living Questionnaire, the Vineland Adaptive Behavior Scales, Bell-Lysaker Emotion Recognition Task, and Social Responsiveness Scale.

Some of the studies used standardized scales to measure respondents' psychosocial outcomes, such as self-efficacy (Connor et al.,

2020; Smith et al., 2014, 2015, 2021; Sung et al., 2019), empathy and psychological wellbeing (Connor et al., 2020; Morgan et al., 2014), quality of life (Gal et al., 2015; Hatfield et al., 2017a; pp. 3, 1270, 2017b, 2018; Pillay et al., 2022), intrinsic motivation (Rosen et al., 2017). A minority of studies used standardized scales to measure job performance, such as the Autism Work Skills Questionnaire (AWSQ) (Gal et al., 2015) and Mock Interview Rating Scale (Smith et al., 2021). These findings denote a lack of standardized scales to measure job-related outcomes of individuals with ASD, pointing to the need for improved outcome measures which are used more consistently to provide a more robust indicator of impact. Nevertheless, this is not to negate the value of equally important, descriptive and observational measures such as self-reports of young autistic employees and anecdotal accounts of their employers evident in 17 of 35 articles included in the corpus.

3.1. Domain 1 - products and technology

Twelve articles reported on the use of products and/or technologies of various degrees of sophistication to prepare students for the workplace. Initial interview poses a well-recognized barrier to employment for autistic individuals. Aside from finding alternatives to the typical job interview, several studies reported on the use of technology to improve job interview skills. For example, a virtual reality interview training simulation used in laboratory-based training sessions (Smith et al., 2014, 2015, 2020, 2021), video modelling even without reinforcement or prompting (Rosen et al., 2017), and a prototype video modelling mobile IOS app (VidCoach) pre-loaded with seven interview videos that allowed users to record their videos as a reply to system-delivered prompts (Hayes et al., 2015) have all resulted in positive outcomes. These interventions were found to lower job interview anxiety and improve self-confidence and actual job interview performance (Hayes et al., 2015; Smith et al., 2014, 2015, 2020, 2021; Rosen et al., 2017; pp. 3, 1270). Similarly, a randomized study using an internet accessed training program (JobTIPS), including video models, visual support, and virtual reality practice sessions to improve the verbal and nonverbal skills of 22 autistic youths found it highly beneficial in improving interview performance (Strickland et al., 2013).

Executive functioning issues impacting organisational skills and task management can be challenging for some autistic individuals. These can be mitigated by a range of high-tech products, such as the Apple iPod Touch, and even low-tech technologies. For example, personal digital assistants (PDAs), useful for teaching task management skills, recording tasks, and setting reminder alarms, have been found to improve independent performance and reduce behavioural challenges at work (Gentry et al., 2010).

Social vocational training programs adopt a variety of products and technologies. At a low-tech level, picture-based communication support has been found to be effective (Richardson et al., 2019). A more sophisticated online transition planning programme for autistic adolescents (BOOST A) increased transition-specific self-determination, self-determination at home, and career exploration through its structured approach. This programme builds on identified strengths, goals and team-based guidance (Hatfield et al., 2017a, 2017b, 2018).

3.2. Domain 2 - natural environment and human-made changes to the environment

This domain has implications for schools, colleges, higher education institutions and workplaces in terms of the adaptations to the material environment or routines, many of which are easily and cheaply achieved in response to sensory and environmental issues affecting the performance of some autistic individuals. Awareness-raising workshops for academic staff, supervisors, and parents as part of an integrated work placement program have been useful in highlighting where adaptations can be made (Lee et al., 2019). Individual needs require individualized responses, necessitating preparatory meetings to assess and agree on adjustments and develop tasks and internship sites to address specific requirements (Wehman et al., 2014, 2017, 2019; Whittenburg et al., 2020).

Accommodations, such as dimming lights or permitting individuals to wear headphones, proved effective in avoiding problems arising from sensory sensitivity (Hedley et al., 2018). Providing reading and scribe accommodations for the participants who have functional illiteracy (Connor et al., 2020; Morgan et al., 2014; Sung et al., 2019) and presenting content in a variety of formats to enhance understanding (e.g., games, role-play, discussion, peer review, and video feedback) were the other environmental changes that helped the autistic participants reach the vocational outcomes. Adjusting working hours according to the individual needs of autistic employees (start and finish time or the number of hours worked) was a strategy deemed achievable by employers, as was taking scheduled breaks (Lee et al., 2019) and arranging a social hour (Connor et al., 2020; Sung et al., 2019) provided opportunities to interact and socialize during the interventions. Visual agendas, content-related images and videos, and video modelling and feedback are the other tools to help the participants generalize their social and communication skills (Connor et al., 2020; Sung et al., 2019). Visual cues, such as visual demarcations of space and cue cards based on pictures or photos, handheld technologies (tablets, cell phones, and iPods to use reminders and video models and communicate with staff and families), and self-monitoring checklists (to track the progress toward the work and/or behavioral goals) can be helpful for interns to complete tasks independently and transition between work activities (Wehman et al., 2014, 2017, 2019; Whittenburg et al., 2020).

3.3. Domain 3 - support and relationships

Positive and supportive relationships are important elements of all human flourishing. For autistic students and employees, they are critical for facilitating the acquisition of social, communication, and vocational skills during the transition to work process. The literature is rich in emphasising the impact of supportive interventions on positive relational development. Social, emotional, and technical support from family, other colleagues, employers, supervisors, educators, and job coaches and developing good relationships with them are identified as important facilitators of many supported employment programs (Gal et al., 2015; Lee et al., 2019; Lynas,

2014; McLaren et al., 2017; pp. 3, 1270; Ruble et al., 2019; Wehman et al., 2017, 2019). Ensuring the correct level of support to all stakeholders involved in the process resulted in better social and vocational outcomes (Ghanouni & Raphael, 2022; Hatfield et al., 2017a; pp. 3, 1270, 2017b, 2018; Lynas, 2014; Ruble et al., 2019; Wehman et al., 2017, 2019).

Parental participation in transition planning and expressing vocational expectations has been identified as a critical predictor of employment outcomes for transition-age autistic youth (Wong et al., 2021). Peer support mechanisms also appear to have an important role to play. Athamanah & Cushing's (2019) evaluation of a peer-mediated intervention on transition-age youth with autism in high school revealed that peers matched with autistic students based on interests, age, personality characteristics, and class schedules successfully trained to use modelling, prompting, and scaffolding helped to increase independent engagement in vocational skills and social interactions, both with peers with and without ASD. Providing adequate social and mediation support and effective professional support before, during, and after the work placement contributed to autistic individuals' quality of life and enhanced their social communication abilities (Bross et al., 2021; Gal et al., 2015; Pillay et al., 2022). Social networks played a significant role in autistic students' and graduates' postgraduate employment mobilities, positively but also negatively, due to previous experiences of bullying (Gaona et al., 2019). Adequate mentoring provided by supervisors and colleagues in an environment supporting emotion regulation and social communication helped students to build self-esteem, confidence, and good relationships with other staff members (Lee et al., 2019). Employment-specific support and individual or community support provided by employment specialists and job coaches helped students demonstrate the expected social skills and vocational behaviors (McLaren et al., 2017; Wehman et al., 2014, 2017, 2019). Supportive statements, verbal encouragement, and technical and vocational guidance provided by job coaches and occupational therapists have been found to improve vocational skills (Chiang et al., 2013; Gaona et al., 2019; Gentry et al., 2010; Hedley et al., 2018). Group-based, soft skills training programs have also been found to enhance trainees' social functioning and cognition, creating space and opportunity to practice social skills and learn prosocial behaviors vicariously through modeling offered by group facilitators and peers (Connor et al., 2020; Sung et al., 2019). Similar group-based programs designed to support self-advocacy skills, emotional regulatory strategies, and non=verbal communication improved the trainees' social pragmatic and problem-solving skills (Morgan et al., 2014).

3.4. Domain 4 – attitudes

Arguably, the most challenging of all domains in creating an inclusive environment is achieving attitudinal change. However, the literature portrays a range of interventions designed to counter negative attitudes and promote inclusivity. Awareness training for employees (Lynas, 2014; Wehman et al., 2017) and reinforcement of supportive staff behavior (Wehman et al., 2017) were effective in instigating positive attitudes towards autistic colleagues. The opportunity of working closely with them, getting to know one another personally, and learning to appreciate their value in interaction with customers, supervisors, and coworkers reduced negative stereotypical attitudes (Hedley et al., 2018; Lee et al., 2019; McLaren et al., 2017; pp. 3, 1270; Richardson et al., 2019; Wehman et al., 2019; Whittenburg et al., 2020).

The role of interagency collaboration (including education, health, and employment sectors) in better post-school outcomes for autistic youths is highlighted by several authors (Gaona et al., 2019; Ruble et al., 2019). However, autistic individuals also have a part to play. Ghanouni and Raphael (2022) suggest that attitudinal change might be usefully fostered by training autistic people to acknowledge their dissimilarities and distinctions, thus increasing their competencies to advocate for themselves and decreasing negative attitudes among employers.

3.5. Domain 5 – services, systems, and policies

Policy-focused articles were few but possibly reflect our search strategy that did not explicitly include the term policy. Mai's (2019) research with hiring agents in the US concludes the need for more 'aggressive diversity initiatives.' In contrast, a large number of studies address programs and services to assist autistic individuals in developing social and vocational skills in the transition to work process (Baker et al., 2018; Cimera et al., 2013; Connor et al., 2020; Gal et al., 2015; Lee et al., 2019; Lynas, 2014; Morgan et al., 2014; McLaren et al., 2017; Ruble et al., 2019; Sung et al., 2019; Wehman et al., 2014, 2017, 2019; Whittenburg et al., 2020).

The need for transition programs to start at an early age (i.e., by age 14), be longitudinal, and individualized has been stressed (Cimera et al., 2013). Indeed, according to Cimera et al. (2013), several states, including Iowa, North Carolina, Nevada, and Mississippi, have already mandated transition programs to commence by age 14. Considering the represented countries covered in the current scoping review, transition planning development starts from age 14 in Canada, England, and Northern Ireland (Ontario Ministry of Education, 2013; Conlon, 2014). However, O'Neill et al. (2016) report that Australian law does not address transition planning, and we did not identify a reliable source to spell out the transition age in Israel.

Investigating the relationship between functional vs. nonfunctional curriculum and post-school outcomes for autistic students, Bouck and Joshi (2015) identified limited functional curricula, poor post-school outcomes, and a lack of relationship between the two. However, they conclude that curriculum is less influential than other in-school experiences (i.e., transition services), a finding supported by Wong et al. (2021), who suggest that support for transition planning, work experience at school, and vocational-related services are key antecedents of vocational outcomes for autistic transition age youth. Nine studies focused on supported employment schemes for autism (Baker Ericzen et al., 2018; Gal et al., 2015; Lee et al., 2019; Lynas, 2014; McLaren et al., 2017; Wehman et al., 2014, 2017, 2019; Whittenburg et al., 2020). These interventions are highly dependent on good multidisciplinary collaboration between all stakeholders (Wehman et al., 2014, 2017, 2019; Whittenburg et al., 2020).

4. Discussion

There are other theoretical models that are undoubtedly useful in understanding systemic mechanisms that might support transitions to employment for autistic youths, such as socioecological approaches that aim to understand how individuals and social ecologies interact (Schoon & Lyons-Amos, 2017). However, in highlighting the interplay between the individual, interpersonal, organizational, community, and societal factors and acknowledging that these interconnections are irrefutable, there is potentially less scope for a focus on environmental interventions in their own right.

We argue that by adopting a scoping review rather than a systematic review that allowed us to map interventions against the five domains of the environmental factors aspect of the ICF, through which the environment can be conceptualized, has provided a useful framework for categorizing these interventions. As well as providing a breadth of insight into the range of successful interventions, the review also highlights which aspects need greater attention in light of the many challenges that autistic individuals face in the transition to employment. The corpus of literature is relatively large and indicative of a wealth of interest in understanding issues around the transition to employment and the obvious gap into which many students fall. The greater volume of research and insight generated over the past 23 years is from the USA and varies in methodological approach and research design. Overall, the literature selected for inclusion sheds light on the strategies, processes, and resources adopted in schools, further and higher education, and the workplace, associated with improved vocational outcomes for autistic individuals. Although the outcome measures are largely descriptive, observational, or anecdotal, they illustrate the impact on employment status, vocational skills, and executive functioning skills. Undeniably, self-reports/anecdotal evidence are invaluable in determining the subjective experiences of people with ASD (Cope and Remigton, 2022; Sindermann et al., 2019). Including voices of autistic individuals' employment experiences to improve the work environment for better employment outcomes, in turn, can increase employee job satisfaction, resulting in more enjoyment, improved quality of life, and overall well-being (Hedley et al., 2017; Holwerda et al., 2013; Walsh et al., 2014). Overall, there appears to be a balance in interventions showing both an educational and growing workplace commitment to enabling and promoting smooth transitions into employment.

We find that interventions fall into three broad types: adaptions that promote a more inclusive physical environment, interventions that promote change and support for autistic individuals in the social environment, typically through training and awareness raising of others, and remedial interventions that seek to change the autistic individual and how they [inter]act with their environment. The ICF themes included in Table 1 provide an overall picture of the focus of current environmental strategies adopted.

The greatest number of studies focus on the support and relationships domain (n = 27). The review highlights substantial evidence supporting the importance of social support and relationship building that requires buy-in from a wide network of family, other colleagues, employers, supervisors, educators, and job coaches offering bespoke social, emotional, and technical support, and point to the need to value and embrace a softer means of evaluating impact. Studies focusing on the provision of tools, products, technologies domain (n = 13) in which the aim is to alter the autistic individual and how they [inter]act with their environment, for example, by using a personal digital assistant, are relatively high in number potentially because they are fairly easy to achieve and evaluate, as evidenced by the studies included in the corpus.

The services, systems, and policies domain studies (n = 15) are biased towards services and systems rather than policies, possibly due to the limitations of our search strategy. The services and system interventions, with the exception of a minority, are relatively small scale and individualized interventions. Arguably, this negates the need for institutional-wide or workplace policy posing an aspect for further empirical research that might investigate policy initiatives. As such, we question whether autism and broader neurodiversity issues get overlooked in diversity and inclusion policies because they have been underrepresented in some instances and are less visible in both educational settings and many workplaces. In addition, it should not be taken for granted that services, systems and policies naturally provide structural facilitators to inclusion, as anecdotally, we know that they can also present unintended barriers. Studies concerned with the natural environment and human-made changes to the environment in which autistic individuals operate were fewer (n = 10) and the attitudes domain (n = 10) were fewer.

The attitudes domain focuses largely on finding ways to change attitudes towards difference but also highlights the part of autistic individuals in self advocacy to challenge and help to dispel negative stereotypes – in itself, a massive challenge. Discussing how hard attitudes are to change, Shulman (2013) suggests that forces exerted by an argument are unlikely to change attitudes. A change in a person's living space is required. He argues that shifts in important attitudes can often only be achieved by significant institutional change. However, here is a conundrum in that institutional change is dependent on individuals who must be signed up for change in terms of products and technology, natural environment and human-made changes to the environment, support and relationships, and services, systems, and policies (WHO, 2001).

The literature cites awareness training for peers, teachers, and co-workers and working alongside autistic colleagues as the major strategies to combat stereotyping and social stigma around autism but here, the causality dilemma springs to mind – if attitudes are best changed through exposure, how is this to be achieved when autistic individuals are excluded from furthering their education or from the workplace.

Just as Ghanouni and Raphael (2022, p.307) argue that 'difficulty achieving positive employment outcomes is multidimensional' our review suggests that so too are the environmental adjustments that can be made to empower autistic students. Again, further research could investigate how the five environmental domains interact to promote positive outcomes.

Whilst many of the discrete environmental interventions discussed have had proven positive impacts, they are undoubtedly more powerful in combination. The environmental domains interact, and given the complexity and individuality of autism, we acknowledge that environmental influences are only part of the picture. However, we suggest that if implemented early in schools, continued through further or higher education institutions, and throughout the transition to employment in the workplace, the adoption of

environmental interventions can make a significant difference to the lived experience of autistic individuals' chances of securing employment.

5. Conclusion

This review sought to address three research questions by conducting a scoping review of existing literature. The first was to identify the types of interventions (strategies, processes, and resources) adopted in schools and further and higher education to facilitate the transition to employment for autistic students. The second question extended this understanding to include interventions in effect in work settings. We have seen that efforts to alter or interact with the environment are occurring in a range of ways in both education settings and the workplace. The third question was to investigate what interventions are used to improve vocational outcomes for autistic individuals across the ICF's environmental domains". Notwithstanding the finding that measures of vocational outcomes might be deemed unreliable since they are in many cases descriptive, use self-report, are observational, or rely on anecdotal evidence, the benefits of interventions have been identified. Improved outcome measures used more consistently would provide a more robust indicator of impact.

Nevertheless, given the wide range of interventions that have been identified and setting these against the statistics that show a large variation in employment rates for autistic individuals (Black et al., 2020; Office for National Statistics, 2020), there seems to be much scope for improvement in the adoption of inclusive strategies. We suggest that even after personal and/or environmental adaptations that improve the functioning of autistic individuals and how they [inter]act with their environment, the crux of the employment gap must rest on the willingness of all stakeholders to make broader environmental changes that have been proved to make a difference to employment potential. Exposure to and raised awareness and tolerance of differences in the needs of autistic individuals are significant defining factors that can swing between inclusion and exclusion. This suggestion based on our analysis aligns with previous comments arguing that barriers to the employment of autistic people 'parallel those of other minority populations – namely, negative attitudes and stereotypes – which in turn impact access to work experience and skill development' (Krzeminska et al., 2019, p.454).

Declaration of Competing Interest

The authors declare that they have no known conflict of interest that has influenced the work reported in this paper.

Data Availability

No data was used for the research described in the article.

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