

1 **Abstract**

2 *Aim:* To holistically synthesise the extent and range of literature relating to the employment of
3 individuals with autism spectrum disorder (ASD).

4 *Methods:* Database searches of Medline, CINAHL, PsychINFO, Scopus, ERIC, Web of Science
5 and EMBASE were conducted. Studies describing adults with ASD employed in competitive,
6 supported or sheltered employment were included. Content analysis was used to identify the
7 strengths and abilities in the workplace of employees with ASD. Lastly, meaningful concepts
8 relating to employment interventions were extracted and linked to the International
9 Classification of Functioning, Disability and Health (ICF) Cores Sets for ASD.

10 *Results:* The search identified 134 studies for inclusion with methodological quality ranging
11 from limited to strong. Of these studies, only 36 evaluated employment interventions that
12 were coded and linked to the ICF, primarily focusing on modifying ASD characteristics for
13 improved job performance, with little consideration of the impact of contextual factors on
14 work participation.

15 *Conclusion:* The ICF Core Sets for ASD are a useful tool in holistically examining the
16 employment literature for individuals with ASD. This review highlighted the key role that
17 environmental factors play as barriers and facilitators in the employment of people with ASD
18 and the critical need for interventions which target contextual factors if employment
19 outcomes are to be improved.

20 **Keywords**

21 Adult, intervention, strengths-based, vocational rehabilitation, work environment

22 **Introduction**

23 Autism spectrum disorder (ASD) is a lifelong neurodevelopmental condition with adult
24 outcome studies revealing that few individuals with ASD live independently, have social
25 relationships, or are employed, experiencing poor mental health and overall quality of life
26 (Hendricks and Wehman, 2009; Howlin et al., 2013; Kirby et al., 2016; Levy and Perry, 2011;
27 Magiati et al., 2014; Seltzer et al., 2004). However, some adults with ASD successfully gain
28 post-secondary qualifications, participate in long-term employment, live independently and
29 engage in social and romantic relationships (Eaves and Ho, 2008; Farley et al., 2009; Billstedt
30 and Gillberg, 2005). It is likely that this variability in outcomes is, at least in part, attributable to
31 the heterogeneity of ASD and variability in personal factors, such as intelligence quotient,
32 language abilities, comorbid conditions (Howlin et al., 2004; Henninger and Taylor, 2013;
33 Farley et al., 2009; Kirby et al., 2016; Magiati et al., 2014), environmental factors including
34 family support, access to interventions, and the availability of support services (Holwerda et
35 al., 2012; Levy and Perry, 2011). While research to date has largely focused on impairment,
36 ASD may also be associated with strengths with the potential to leverage improvements in
37 functioning and quality of life (de Schipper et al., 2015; Mottron et al., 2009).

38

39 Individuals with ASD possess strengths and abilities, which can be harnessed in the work
40 environment, often performing well in jobs requiring systematic information processing and a
41 high degree of accuracy, precision and repetition (Baldwin et al., 2014; de Schipper et al.,
42 2016; Walsh et al., 2014). Capitalising on these strengths (Clifton and Harter, 2003) and
43 focusing on the person-job-environment fit (Lorenz and Heinitz, 2014) could support successful

44 outcomes for people with ASD in a variety of employment contexts (Hendricks, 2010;
45 Mawhood and Howlin, 1999). However, despite increasing recognition of the potential
46 contribution that individuals with ASD can make in the workplace, they continue to experience
47 many challenges securing and maintaining employment (Hendricks, 2010; Hurlbutt and
48 Chalmers, 2004; Howlin and Moss, 2012). This is partly driven by models of service which
49 continue to focus on remediating impairments, with little regard for the strengths of people
50 with ASD, perpetuating low expectations and ultimately poor employment outcomes
51 (Holwerda et al., 2012; Lorenz and Heinitz, 2014).

52

53 Australian adults with ASD participate in employment at a rate of 42%, in comparison to 53%
54 of all individuals with disabilities, and 83% of individuals without disabilities (Australian Bureau
55 of Statistics, 2009; Australian Bureau of Statistics, 2010). In the United Kingdom, 15% of adults
56 with ASD of working age are in full-time paid employment (Mavranezouli et al., 2013;
57 Rosenblatt, 2008), and only 34% (aged 21-48 years) have ever participated in 'some' form of
58 employment, inclusive of independent work, self-employed or sheltered employment (Howlin
59 et al., 2004). Similarly, in the United States 58% of young adults (aged 18-25 years) with ASD
60 have worked for pay, and only 21% are in full-time employment (Bureau of Labor Statistics,
61 2013; Roux et al., 2015). While some individuals with ASD do find employment, many work in
62 positions below their qualifications or skill level, working reduced hours and receiving lower
63 rates of pay than their co-workers in comparative positions (Roux et al., 2015; Shattuck et al.,
64 2012; Howlin et al., 2004). At the individual level, poor employment outcomes among adults
65 with ASD negatively impact socioeconomic status, quality of life and mental health (Gerhardt

66 and Lainer, 2011; Wanberg, 2012; Fleming et al., 2013), and at the societal level on lost
67 productivity and increased reliance on government funding (Krieger et al., 2012; Järbrink et al.,
68 2007; Roux et al., 2013).

69

70 Employment commonly occurs within environments that are potentially challenging for
71 individuals with ASD (Leonard et al., 2010; Müller et al., 2003; Nord et al., 2016). In the life
72 area of work and employment, the hallmark impairments of ASD manifest in difficulties
73 mastering the job application process, remembering and following instructions, interacting and
74 communicating effectively with co-workers, and integrating into the workplace culture
75 (Baldwin et al., 2014; Krieger et al., 2012; Müller et al., 2003). It is however likely that the low
76 levels of participation in employment are influenced by environmental factors such as
77 employers' attitudes and concerns over real and perceived barriers to employing individuals
78 with ASD including accommodation costs, additional supervision needs, sick leave, workforce
79 heterogeneity and concern in relation to employee productivity (Unger, 2002; Ju et al., 2013;
80 Hernandez and McDonald, 2010). Common employment processes and practices such as
81 traditional approaches to job advertising and interviewing (Strickland et al., 2013; Scott et al.,
82 2015) and job descriptions requiring generic skills such as teamwork and social-communication
83 skills that are not always essential to the job role, are also likely barriers to securing
84 employment for this group (Fraser et al., 2011; Richards, 2012).

85

86 Employment services assist individuals with ASD with recruitment, the interview process, job
87 placement, workplace accommodations and ongoing support. While employment services aim

88 at maximizing employment outcomes for individuals with ASD, they remain less than optimal
89 and do not provide sufficient and appropriate supports (Lawer et al., 2009; Nicholas et al.,
90 2014; Alverson and Yamamoto, 2016; Anderson et al., 2017). Often employment services
91 overlook the social support needs and on-the-job training required by employees with ASD and
92 have a tendency to treat their needs homogenously (Richards, 2012; Nicholas et al., 2014).
93 Many employment service providers are not trained to comprehensively meet the unique and
94 varying needs of ASD, nor do they have an understanding of the strengths of this population to
95 assist with providing individualised ASD-specific support for employment success (Chen et al.,
96 2015a; Müller et al., 2003). The costs associated with providing vocational supports for ASD
97 may also be a barrier for employment services. The ASD group is considered one of the most
98 costly populations to support in employment, receiving the highest varying and number of
99 supports, remaining longer in the service system yet achieving comparatively poorer
100 employment outcomes to other disabilities (Cimera and Cowan, 2009; Burgess and Cimera,
101 2014; Chen et al., 2015b; Seaman and Cannella-Malone, 2016). This is problematic given the
102 increasing number of individuals with ASD requiring and utilising vocational support services
103 (Burgess and Cimera, 2014). It is essential that our understanding about the type and level of
104 support required improves, along with the role that extrinsic social and environmental factors
105 play in fostering employment success for individuals with ASD (Nicholas et al., 2014; Kirby et
106 al., 2016).

107

108 Employment for adults with ASD can be holistically conceptualised using the *International*
109 *Classification of Functioning, Disability and Health* (ICF) framework. The ICF takes a

110 biopsychosocial perspective of health, providing a scientific basis and standardised language
111 for coding and classifying health and health-related states (World Health Organization, 2001).
112 The classification of health and health-related states are described in two parts, each
113 consisting of two components. *Part 1 'Functioning and Disability'* includes the components of,
114 *Body Functions and Structures* (i.e., physiological functioning and anatomical parts of the body)
115 and *Activities and Participation* (i.e., execution of a task and involvement in a life situation
116 respectively). *Part 2 'Contextual Factors'* includes the components of, *Environmental factors*
117 (i.e., physical, social and attitudinal environment) and *Personal Factors* (i.e., social and cultural
118 factors intrinsic to the individual) (World Health Organization, 2001). Using taxonomic
119 principles and a hierarchical structure, the ICF organises three of the distinct components
120 described above (i.e., Body Functions and Structures, Activities and Participation and
121 Environmental Factors) into four levels of increasing detail (World Health Organization, 2001).
122 The first level of categorisation refers to the relevant chapters within the ICF, with each
123 chapter providing a general overview of the areas of functioning. Each chapter comprises of
124 second, third and fourth level categories. For example, an ASD-relevant classification from the
125 *Activities and Participation* component shows the hierarchical structure of the ICF:

- 126 • Level 1 chapter: d7 Interpersonal interactions and relationships
- 127 • Level 2 category: d710 Basic interpersonal interactions
- 128 • Level 3 category: d7104 Social cues in relationships
- 129 • Level 4 category: d71040 Initiating social interactions

130

131 The ICF perceives an individual's functioning and disability as a dynamic process resulting from
132 interactions between the health condition and contextual factors, i.e., the outcome of work
133 participation and employment is a result of the interaction of an individual with ASD and the
134 environmental factors (McDougall et al., 2010; World Health Organization, 2001; Schneidert et
135 al., 2003). Given the many factors influencing work participation and employment of
136 individuals with ASD, the ICF framework is useful in capturing this complex group of
137 intertwined variables and organising this information in a meaningful, interrelated and easily
138 accessible way (World Health Organization, 2001). However, with more than 1650 categories
139 to describe an individual's functioning, using the ICF in its entirety remains too generic and
140 unfeasible (Finger et al., 2012; Stuckl et al., 2002). In an attempt to address this limitation, 'ICF
141 Core Sets, or a condensed list of categories or domains of the ICF relevant to a specific health
142 condition (e.g., ASD) or setting (e.g., the workplace)' (Finger et al., 2012)^[p430], have been
143 defined. The development of the ICF Core Sets for ASD enables consideration of functioning
144 across the lifespan and understanding of participation in major life areas, including
145 employment (Bölte et al., 2014; de Schipper et al., 2015; de Schipper et al., 2016; Bölte et al.,
146 2017). The implementation of the ICF Core Sets for ASD will be particularly useful in organising
147 the ASD employment literature according to the target of interventions in relation to *Body*
148 *functions* and *Activities and Participation*, and the modality of the interventions in relation to
149 *Environmental factors*. The organisation of the ASD employment literature will highlight the
150 gaps in current employment interventions, while re-inforcing successful interventions and their
151 associated outcomes.

152

153 Although the number studies examining employment interventions and outcomes has almost
154 doubled in recent years, much remains unknown. This scoping review examines the extent and
155 range of literature relating to the employment of individuals with ASD, employing the ICF as a
156 framework to summarise and synthesise findings with the goal of informing future research
157 and policy, and advancing evidence-based practice. As such, the primary objectives of this
158 review were to: i) holistically and comprehensively review the employment literature and
159 employ the ICF framework (World Health Organization, 2001); ii) explore measures used in
160 evaluating employment outcomes; iii) identify the skills and abilities of individuals with ASD
161 that contribute to successful employment; iv) describe, classify and link to the ICF current
162 employment programs and interventions in ASD (Cieza et al., 2005); and v) summarise the
163 overall outcomes of interventions and support programs.

164 **Methods**

165 A scoping review examined the employment of individuals with ASD, supporting the mapping
166 of key concepts underpinning the research, synthesising the literature and identifying gaps in
167 the evidence, ultimately supporting the dissemination of findings to consumers, researchers
168 and policy makers (Arksey and O'Malley, 2005). The review adopted the methodology for
169 scoping reviews articulated by Arksey and O'Malley's (Arksey and O'Malley, 2005) and refined
170 by Daudt et al. (Daudt et al., 2013) and Levac et al. (Levac et al., 2010), in: (a) identifying the
171 research aims and objectives; (b) searching for relevant studies; (c) systematically selecting
172 studies; (d) charting data; (e) collating, summarising and reporting the results including a
173 methodological assessment of quality; and (f) consulting with stakeholders to inform or
174 validate study findings (Arksey and O'Malley, 2005).

175 *Search strategy*

176 Scoping search strategies promote a comprehensive and broad search of the literature,
177 employing multiple sources (Levac et al., 2010). The literature was searched using electronic
178 databases Medline (1966), CINAHL (1982), PsychINFO (1920), Scopus (1960), ERIC (1992), Web
179 of Science (1972) and EMBASE (1947) for publications from their earliest records to their most
180 recent (June 2018). A further computer search of reference lists of all relevant retrieved
181 articles identified additional significant papers, and employment policies, reports and
182 proceedings retrieved from relevant government websites, networks and organisations. Search
183 terms used were grouped in relation to: (i) diagnosis; (ii) age; (iii) intervention; and, (iv)
184 outcome (Table 1). Combinations of search terms were identified, truncated, exploded and
185 adjusted to achieve optimal results with the assistance of a librarian to comply with each of
186 the databases.

187 [Insert Table 1 about here]

188

189 *Study selection*

190 The scoping review process is iterative, involving a multidisciplinary team to ensure a
191 transparent, replicable and rigorous process (Levac et al., 2010). Authors defined and refined
192 the inclusion criteria, based on increasing familiarity with the literature (Arksey and O'Malley,
193 2005). Following the inventorying and study of abstracts, the research question was revised.
194 Studies were included if, i) participants were individuals with ASD (including autism, Asperger's
195 disorder or pervasive developmental disorder not otherwise specified (PDD-NOS), with or
196 without an intellectual disability, and 18 years or older. Although the inclusion criteria

197 stipulated participants should be 18 years and older, studies were included if a subset of the
198 participants were under the age of 18, but the mean age of participants was ≥ 18 years; ii)
199 described the process of finding, gaining and maintaining employment (including the terms
200 competitive, supported, sheltered employment, vocational activities, work experience or
201 internships); iii) reported the use of any employment programs, interventions or vocational
202 supports and iv) published or translated in English. Studies were excluded if the documents
203 were a book or book chapter, editorial or opinion piece, and if they focused on transition
204 planning. Four reviewers independently assessed the relevance of the selected articles.

205 *Charting the data*

206 Data were extracted from the selected articles according to the pre-determined framework
207 (Arksey and O'Malley, 2005). Descriptive study characteristics were charted and organised by
208 unique reference number, author, year of publication, country, design, participants, outcome
209 measures, nature and stage of employment and quality and level of evidence.

210 *Assessment of methodological quality*

211 Methodological quality was independently assessed by two reviewers according to the
212 *Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of*
213 *Fields* (Kmet et al., 2004), comprising a checklist of 10 items for qualitative studies and 14
214 items for quantitative studies, underpinning calculation of an overall score of study quality.
215 Scores were represented as percentages with the strength of the evidence categorised as
216 strong ($> 80\%$), good (70-80%), adequate (50-70%) or limited ($< 50\%$) (Lee et al., 2008). Any
217 inconsistencies between reviewers were resolved by discussion. The same two reviewers also

218 determined the level of evidence of each study based on the guidelines developed by the
219 Joanna Briggs Institute (The Joanna Briggs Institute, 2014).

220 *Collating, summarising and reporting the results*

221 Search results were analysed using a combination of techniques. Descriptive analysis
222 characterised included studies, mapping the data, revealing the distribution of studies across
223 employment type, focus of employment programs or interventions and overall employment
224 outcomes (direct and indirect). Assessment of the methodological quality of included studies
225 provided an understanding of the strength of the evidence in relation to the study design
226 (Kmet et al., 2004). Content analysis was used to analyse the content of the literature
227 according to the pre-established categories of “*ASD-related abilities*” as described by de
228 Schipper et al. (de Schipper et al., 2016), quantitatively investigating the frequency of the
229 terms relating to ASD-related skills and abilities, and qualitatively focusing on the meaning and
230 interpretation of the strengths that individuals with ASD contribute to the workplace (Joffe and
231 Yardley, 2004).

232 *Identifying and linking meaningful concepts to the ICF*

233 Meaningful concepts were identified and extracted in relation to the target and modality of
234 the intervention and then linked to the *Body functions, Activities and Participation* and
235 *Environmental factors* components according to the linking rules and procedures described by
236 Cieza et al. (Cieza et al., 2005; Cieza et al., 2002). In cases where concepts were too broad and
237 ICF categories could not be identified, specific codes were assigned, including; a) “*not definable*
238 (*nd*)”, when information provided by a meaningful concept was not sufficient to assign to an
239 ICF category; b) “*personal factor (pf)*”, when a concept was not contained in the ICF, but was

240 clearly a personal factor as defined by the ICF; c) “*not covered (nc)*”, when a concept was not
241 contained within the ICF and was clearly not a personal factor; and d) “*health condition (hc)*”,
242 when a concept referred to diagnosis or condition (Cieza et al., 2005). Identification and
243 linkage of meaningful concepts to ICF categories were conducted independently by four
244 researchers with linking experience, ensuring the quality and consistency of the results. Linking
245 results of each of the researchers were compared, with any variance discussed to verify
246 concepts and categories until consensus was reached.

247 ***Application of the ICF Core Sets for ASD***

248 The linking process was informed by the ICF Core Sets for ASD (Bölte et al., 2017), which have
249 been developed in response to the need for a standardised tool describing functioning in ASD
250 across the lifespan (Bölte et al., 2014; Selb et al., 2015), with this review employing the *brief*
251 ICF Core Sets for ASD inclusive of those categories essential in describing ASD (Cieza et al.,
252 2004; Finger et al., 2012). The application of the *brief* ICF Core Sets for ASD was useful in
253 identifying the targets of employment programs and highlighting the potential targets of
254 future interventions. The targets, modality and outcomes of employment programs and
255 interventions were linked to the *brief* ICF Core Sets for ASD at the second-level. Further linkage
256 to the third and fourth-level was undertaken using the ICF Children and Youth version (ICF-CY)
257 (World Health Organization, 2007), as a supplement to the core sets. The frequency of each
258 category was counted in accordance with the rule that if the same category was assigned more
259 than once to the same employment program or intervention, it was counted only once in the
260 analysis (Selb et al., 2015).

261 *Consulting with stakeholders*

262 While considered an optional step in the review process (Arksey and O'Malley, 2005),
263 consultation with consumers and the community was deemed an important and useful step in
264 guiding all aspects of the review. Consultation with a community reference group occurred
265 throughout the analysis and reporting of this review to validate findings and inform further
266 stages of the research project.

267 **Results**

268 A total of 4,114 references were identified, reduced to 2,434 after the removal of duplicates
269 and inappropriate reference types. Article titles and abstracts were reviewed according to the
270 inclusion criteria, and when information for inclusion was lacking, full text copies of the articles
271 were retrieved and reviewed, with a final $K=134$ articles meeting the inclusion criteria (Figure
272 1). The majority of identified articles were from the United States ($k=87$), followed by the
273 United Kingdom ($k=12$), Australia ($k=8$) and Sweden ($k=4$). Eighty-four studies were
274 quantitative, of which 22 studies extracted information from national databases rather than
275 directly from participants, 44 were qualitative in design and five were reports and one used a
276 mixed-methodology design. Given the high number of articles included in this review, the
277 analysis of the 134 articles were divided into two categories, i) general articles relating to
278 employment outcomes ($k=98$); and, ii) articles evaluating employment programs and
279 interventions ($k=36$).

280 [Insert Figure 1 about here]

281 *General articles relating to employment outcomes (k=98)*

282 ***Quality assessment of studies and levels of evidence***

283 A broad range of evidence was identified. The majority of research articles were rated from
284 level II (quasi-experimental designs) through level V (expert opinion and bench research), with
285 only four articles rated as level I evidence, according to the Joanna Briggs Institute hierarchy of
286 scientific evidence for meaningfulness.

287 Overall the methodological quality of the included articles ranged from limited (k=18), to
288 adequate (k=16), to good (k=12) to strong (k=52). (Kmet et al., 2004). Shortcomings of
289 quantitative studies (k=59) included the absence of control groups, a lack of random allocation,
290 small sample sizes, implementation of poorly described or non-standard interventions, along
291 with non-blinded assessments and imprecise measurements of outcomes. Qualitative studies
292 (k=33) were limited by failures to adequately report methodological design and procedures
293 including the absence of discussion in relation to if findings achieved a saturation, participants
294 self-selecting as having ASD rather than confirmation of diagnosis, collectively impacting on
295 the transferability and credibility of findings. Table 2 summarises the descriptive characteristics
296 of the employment outcome studies only (k=98).

297 [Insert Table 2 about here]

298 ***Employment settings***

299 Articles were categorised according to employment type, including vocational skills training,
300 such as work experience or an internship, and sheltered, supported or competitive
301 employment. The majority of articles (k=98) focused on participants with ASD finding and
302 securing roles in paid, supported or competitive employment, while 16 studies investigated

303 work experience or vocational skills training with the goal of individuals eventually obtaining
304 supported or competitive employment (Allen et al., 2010a; Allen et al., 2010b; Arikawa et al.,
305 2013; Briel and Getzel, 2014; Burgess and Cimera, 2014; Burke et al., 2010; Burke et al., 2013;
306 Dotson et al., 2013; Gal et al., 2015b; Gilson and Carter, 2016; Hayes et al., 2015; Seaman and
307 Cannella-Malone, 2016; Anderson et al., 2017; Baker-Ericzen et al., 2018; Rosen et al., 2017;
308 Walsh et al., 2018). One study explored whether participating in sheltered workshops prior to
309 engaging in supported open employment improved vocational outcomes for individuals with
310 ASD (Table 2) (Cimera et al., 2012). A cluster of 20 articles explored and compared vocational
311 outcomes across a variety of employment settings in relation to factors predicting outcomes
312 (Holwerda et al., 2012; Howlin et al., 2004; Bush and Tassé, 2017) including, supports and
313 services required (Autism Europe, 2014; Gladh and Sjölund, 2014; Hendricks, 2010;
314 McDonough and Revell, 2010; Morgan and Schultz, 2012; Nicholas et al., 2014; Roux et al.,
315 2015; Taylor and Seltzer, 2011; Taylor and Seltzer, 2012; Walsh and Hall, 2012; Rashid et al.,
316 2017; Smith et al., 2017; Nicholas et al., 2017a), the associated costs of ongoing support
317 employment services (Järbrink et al., 2007; Migliore et al., 2014; Cimera and Cowan, 2009),
318 and quality of life outcomes (Garcia-Villamisar et al., 2002). Articles were reviewed for the
319 stage of employment, including job preparation, job acquirement and job retention. While job
320 termination is an important aspect of the employment process, it did not feature in the
321 published research, other than a few papers addressing it as a discussion point. Articles
322 predominantly focused on securing and maintaining a job, with less consideration for job
323 preparation, an aspect more likely to be addressed in the transition literature, which was
324 outside the scope of this review.

325 ***Outcome measures***

326 Overall, measures utilised in the employment outcomes studies were primarily characterised
327 as descriptive and observational, with several studies developing their own outcome tools
328 (Howlin and Moss, 2012; Lorenz et al., 2016; Müller and Vangilder, 2014; Ohl et al., 2017).
329 Outcomes were reported according to job type, hours worked, wages earned, and support
330 services required, and were supplemented by employee self-reports and anecdotal employer
331 accounts of job performance. The few studies employing standardised measures ($k=16$) utilised
332 published measures to corroborate and standardise ASD diagnosis (e.g., Autism Diagnostic
333 Interview-Revised), general intellectual abilities (e.g., Wechsler Adult Intelligence Scales),
334 autistic trait severity (Social Responsiveness Scale version 2) and adaptive behaviour (Scales of
335 Independent Behaviour-Revised). Four articles utilised standardised employment-related
336 measures, including the Autism Work Skills Questionnaire (AWSQ) (Gal et al., 2015a), the
337 Vocational Index (Taylor and Seltzer, 2012), the Work Performance Evaluation (WPE) (Katz et
338 al., 2015) and one study examining perceived effort-reward balance at work using the Short
339 Effort Reward Imbalance Questionnaire (ERI) (Ohl et al., 2017). Only three studies explored the
340 impact of employment on quality of life (Gal et al., 2015b; Garcia-Villamizar et al., 2002; Katz et
341 al., 2015).

342 ***Content analysis of ASD-related abilities contributing to employment***

343 A sub-group of articles relating to employment outcomes were identified as recognising the
344 skills and abilities that individuals with ASD bring to the workplace. According to the ICF, these
345 specific ASD-related skills and abilities are considered *personal factors*. While personal factors
346 are not classified within the ICF due to their unique and varying characteristics, their

347 contribution to an individual's disability and functioning may impact on the outcomes of an
348 intervention (World Health Organization, 2001). Given ASD-related skills and abilities could not
349 be linked to the ICF, content analysis was employed to identify the skills and abilities of
350 individuals with ASD contributing to successful employment by examining and coding the
351 results sections only of articles according to the ASD-related ability categories, as described by
352 de Schipper et al. (de Schipper et al., 2016). In total, 14 studies described results which aligned
353 either with the previously described strengths of participants with ASD (de Schipper et al.,
354 2016), or with additional skills and abilities in relation to punctuality, low absenteeism, high
355 quality of work, prompt task commencement and strong work ethic, included in the category
356 of 'other' (Table 3).

357 [Insert Table 3 about here]

358 *Articles evaluating employment programs and interventions (k=36)*

359 A total of 36 articles describing and evaluating employment programs and interventions for
360 individuals with ASD were included in the linking process. Articles comprised of a total of 556
361 participants, with a mean age of 23.6 (SD=6.4) years, of which 84% were male. Table 4
362 summarises the descriptive characteristics of the selected employment program and
363 intervention studies (k=36).

364 [Insert Table 4 about here]

365

366 ***Quality assessment of studies and levels of evidence***

367 The level of evidence of research evaluating employment programs and interventions was
368 rated according to the Joanna Briggs Institute hierarchy of scientific evidence for
369 meaningfulness, from level I (experimental designs) through to level V (expert opinion and
370 bench research), with the majority of articles rated as level II evidence (quasi-experimental
371 designs) ($k=21$) (The Joanna Briggs Institute, 2014). Many articles either described or evaluated
372 the effectiveness of an employment program or intervention with common study designs
373 including multiple-baseline ($k=12$), case studies ($k=8$), randomised controlled trials ($k=7$),
374 cohorts ($k=3$), pretest-posttests ($k=4$) and case-control ($k=2$) (Table 4).

375 The methodological quality of program and intervention studies ranged from limited ($k=8$);
376 adequate ($k=12$); good ($k=3$) and strong ($k=13$) (Kmet et al., 2004; Lee et al., 2008). Limitations
377 included small sample sizes, a lack of employment outcome measures resulting in a reliance on
378 employee self-report and anecdotal employer accounts on job performance in the workplace,
379 costly implementation of technology-based interventions, and poor translation of
380 interventions and programs into actual employment contexts.

381 ***Employment programs and interventions***

382 Studies included in this review targeted the various stages of the employment process
383 including preparing, finding and securing and maintaining employment (Table 4). Of the
384 included studies, 13 focused on employment preparation using video modelling, role playing or
385 group training in teaching the necessary social, communication and vocational skills commonly
386 utilised in acquiring a job. One study primarily focused on gaining employment through
387 Individual Placement Support (McLaren et al., 2017) and eight studies focused on maintaining

388 a job, primarily employing behavioural and task management strategies delivered through
389 technology, simulation training or job coaches. The remaining 14 studies addressed two or
390 more stages of the employment process, with programs and interventions initially targeting
391 one stage and their respective outcomes targeting another, such as role play used in teaching
392 the appropriate social-communication skills in preparing for a job interview, that when
393 implemented resulted in successfully securing a job (Smith et al., 2014; Strickland et al., 2013).
394 Comparison groups varied. A pre-post study evaluated a manual-based workplace intervention
395 compared to a no treatment group of typically developing adults (Bonete et al., 2015). The
396 Personal Digital Assistant intervention used a delayed RCT, with the control group receiving
397 PDAs 12-weeks after beginning job placement (Gentry et al., 2015). An interview skills group
398 RCT used waitlist control (Morgan et al., 2014). The remaining five RCTs included were all
399 compared to no-treatment groups (Hayes et al., 2015; Smith et al., 2014; Strickland et al.,
400 2013; Wehman et al., 2014; Wehman et al., 2016b).

401 ***Intervention outcomes***

402 Three broad outcomes; employment status, vocational skills and executive functioning skills
403 were evaluated (Table 4).

404 *Employment status*

405 Changes in employment status were examined in 12 of the 36 included studies (Burt et al.,
406 1991; Ham et al., 2014; Hill et al., 2013; Hillier et al., 2007; Lynas, 2014; Mawhood and Howlin,
407 1999; Wehman et al., 2012; Wehman et al., 2013; Wehman et al., 2016b; Wehman et al., 2014;
408 Baker-Ericzen et al., 2018; McLaren et al., 2017); measures utilised were descriptive in nature,
409 such as employment level, wages earned, hours worked and job retention, only two

410 standardised measures used, including the Work Personality Profile and the Support Intensity
411 Scale (SIS). The two RCTs by Wehman et al. (Wehman et al., 2014; Wehman et al., 2016b)
412 evaluated the effectiveness of the 'Project SEARCH plus Autism' intervention, a transition-to-
413 work support program in comparison to high school special education services as usual. The
414 RCTs found a statistically significant increase in the number of participants in the experimental
415 group employed following the program compared to controls ($p=0.0001$), with an 87% job
416 retention rate at the 12-month follow-up compared to the control group's 12% job retention
417 rate. A study by Mawhood and Howlin (Mawhood and Howlin, 1999) evaluated an autism-
418 specific employment support program, with the experimental group attaining significantly
419 higher rates of full-time or casual employment ($p=0.01$), higher wages ($p=0.02$) and requiring
420 less support over a 2-year period ($p=0.001$) compared to the control group. The remaining
421 studies reported increased job placement and retention for individuals with ASD following
422 intensive work-training programs and job coaching. Overall, jobs were retained from between
423 6 and 30 months, wages earned ranged between US \$5.01-\$18 and an average of 25.45
424 hours/week were worked (Burt et al., 1991; Ham et al., 2014; Hillier et al., 2007; Wehman et
425 al., 2012; Wehman et al., 2013; Wehman et al., 2014; Wehman et al., 2016b; Baker-Ericzen et
426 al., 2018; McLaren et al., 2017).

427 *Vocational skills*

428 Twenty-three studies evaluated the change in vocational skills used in completing work-related
429 tasks, socialising in the workplace and communicating, as shown in Table 4. A variety of
430 standardised measures were used including the Job Observation and Behaviour Scale (Bennett
431 et al., 2010), Evaluation for the Solutions to Interpersonal Conflicts and Osnabrück Ability to
432 Work Profile (Bonete et al., 2015), The Scales of Independent Behaviour-Revised (Dotson et al.,

433 2013; Liu et al., 2013), Supports Intensity Scale (SIS) (Gentry et al., 2015; Wehman et al., 2014;
434 Wehman et al., 2016b), Employee Performance Evaluation Report (Gentry et al., 2015), Social
435 Responsiveness Scale-2 (Smith et al., 2014; Strickland et al., 2013), Social Skills Improvement
436 Rating Scales (Walsh et al., 2018), repeatable battery for the assessment of neuropsychological
437 status and Bell-Lysaker Emotion Recognition Task (Smith et al., 2014). A useability study of a
438 video-modelling intervention found that individuals with ASD had greater difficulty selecting
439 adaptive social responses during workplace scenarios compared to typically developing
440 controls ($P=0.02$). Though reporting that the video-modelling intervention provided less choice
441 than controls ($p=0.01$), they reported that it was more enjoyable ($p=0.02$) and personally
442 relevant ($p<0.05$), indicating its potential in improving social skills in vocational contexts (Rosen
443 et al., 2017). A RCT by Bonete et al. (Bonete et al., 2015) found the experimental group
444 reported significantly higher social problem-solving skills ($p<0.001$) and socialisation in the
445 workplace ($p<0.001$) compared to the control group. In a RCT by Gentry et al. (Gentry et al.,
446 2015), personal digital assistants improved the experimental group's task organisation skills
447 resulting in significantly less hours of job coaching support ($p=0.013$) compared to the control
448 group. Another RCT evaluating interview performances using video modelling (Hayes et al.,
449 2015) revealed significant improvements in interview performances ($p<0.001$) and associated
450 grooming and hygiene ($p=0.02$) compared to the control group. A pre-post study (Liu et al.,
451 2013) found their workplace training program to significantly improve the experimental
452 group's social communication skills in the workplace ($p=0.02$) compared to the control group
453 and found improvements in their social workplace behaviours ($p=0.08$). The RCT examining the
454 effectiveness of interview skills training (Smith et al., 2014) revealed significantly greater skills
455 in role-play performance for interviews ($p=0.04$) and improvements in self-confidence ($p=0.06$)

456 compared to controls. Strickland's RCT (Strickland et al., 2013) evaluated the effectiveness of
457 teaching interview skills reporting the experimental group ($p < 0.001$) demonstrated
458 significantly more effective verbal skills during an interview than controls. A pilot study of the
459 SUCCESS intervention, targeting cognitive and social skills, used an adapted version of the
460 Social Skills Performance Assessment to provide a measure of social skills within a vocational
461 context. Following the intervention, individuals with ASD showed improvements in both
462 communicating with co-workers and requesting time off ($p < 0.05$). While not reaching
463 statistical significance, parents also reported improved hygiene in areas such as dressing
464 professionally) (Baker-Ericzen et al., 2018). The remaining studies primarily evaluated the
465 effectiveness of vocational skills training via observation and self-report measures (Allen et al.,
466 2010a; Allen et al., 2010b; Bennett et al., 2010; Burke et al., 2010; Burke et al., 2013; Dotson et
467 al., 2013; Gilson and Carter, 2016; Kellems and Morningstar, 2012; Lattimore et al., 2006;
468 Lattimore et al., 2008; Lynas, 2014; Morgan et al., 2014; Rausa et al., 2016) reporting an
469 increase in workplace social interaction skills and the completion of targeted vocational tasks.

470 *Executive functioning skills*

471 Changes in executive functioning skills were examined in 11 of 36 included studies (Arikawa et
472 al., 2013; Gentry et al., 2012; Ham et al., 2014; Schall, 2010; Smith and Coleman, 1986; Baker-
473 Ericzen et al., 2018), with five reporting positive changes in vocational skills, particularly in
474 relation to employees' self-management of their workplace behaviours (Burke et al., 2010;
475 Hayes et al., 2015; Liu et al., 2013; Morgan et al., 2014; Wehman et al., 2013). Outcome
476 measures included observation (Arikawa et al., 2013; Burke et al., 2010; Ham et al., 2014;
477 Smith and Coleman, 1986), self-report (Gentry et al., 2012; Hayes et al., 2015; Wehman et al.,
478 2013) and functional behaviour assessments (Schall, 2010). Standardised measures were used

479 in only two studies. Liu et al. (2013) used the Observational Emotional Inventory Revised,
480 reporting that their workplace training program improved the experimental group's emotional
481 response to socialisation resulting in improved concept of self ($p=0.04$) compared to controls.
482 The Delis-Kaplan Executive Functioning System (DKEF-S) and the Behavior Rating Inventory of
483 Executive Functioning – Adult (BRIEF-A) was used to provide a measure of executive
484 functioning in a pilot study of the SUCCESS intervention, with improvements in both
485 assessments observed ($p<0.05$) post intervention (Baker-Ericzen et al., 2018). The RCT
486 conducted by Hayes et al. (Hayes et al., 2015) demonstrated significant improvements in the
487 experimental group in presenting ideas logically and succinctly during an interview ($p=0.009$).
488 Overall, studies examining executive functioning skills found that job coaches who
489 implemented support strategies and the use of technology, such as iPods, assisted in
490 participants' task management, problem-solving and organisational skills, improved
491 participants' ability to self-regulate their workplace behaviours, subsequently increasing their
492 productivity.

493 *Linking employment program and intervention results*

494 In total, 2,372 meaningful concepts were extracted from the 36 selected articles describing the
495 evaluation of employment programs and interventions for individuals with ASD, as described in
496 the previous section. These concepts were linked according to the target of the intervention, in
497 relation to *Body functions* and *Activities and Participation*, and the modality of the intervention
498 in relation to *Environmental factors* (Appendix A). For example, an intervention targeting
499 adults with ASD (*Body functions*) to improve their communication, professional behaviour and
500 self-confidence skills in participating in a job interview (*Activities and Participation*), was

501 delivered via a virtual reality software program (*Environmental factor*) (Smith et al., 2014).
502 According to this linking process, concepts were linked to a total of 131 unique ICF categories
503 from the first to the fourth level of classification. The target of interventions accounted for
504 87% of linked categories, with the modality of the intervention only accounting for 13% of
505 categories. In this review, the absolute and relative frequency for the 38 second-level ICF
506 categories, with only the categories identified in at least 5% of the linked articles are reported.
507 Three of the ICF components are represented by these categories, with 22 from *Activities* and
508 *Participation*, eight from *Environmental factors* and eight from *Body functions* (Table 4). No
509 categories were reported that related to *Body structures*.

510 ***Activities and Participation***

511 The greatest contribution of meaningful concepts were second level categories within the
512 *Activity and Participation* component of the ICF (Table 5). Six of the nine chapters are
513 represented, with Chapter 3 *Communication* denoting the main target of employment
514 programs and interventions, with the categories, d310 *Communicating with-receiving-spoken*
515 *messages*, d315 *Communicating with-receiving-non-verbal messages*, d330 *Speaking*, d350
516 *Conversation* and comprising the focus of interventions in more than half the studies ($k=20$).
517 Subsequently, Chapter 8 *Major life areas*, included the most frequently identified second level
518 category, d845 *Acquiring, keeping and terminating a job*, which was both the target of
519 programs or interventions and the measured outcome in the majority of studies ($k=27$). The
520 chapters of *(d1) learning and applying knowledge*, *(d2) general tasks and demands*, *(d5) self-*
521 *care* and *(d7) interpersonal interactions and relationships*, spanned the remaining categories
522 associated with the intervention targets of the studies, which were overall aligned with well
523 recognised work-related needs of individuals with ASD (Chen et al., 2015a).

524 [Insert Table 5 about here]

525 ***Environmental factors***

526 Linking of meaningful concepts associated with *Environmental factors* component revealed
527 that three of the five chapters were represented (Table 6). The most frequently linked
528 category was e360 *Other professionals*, which described job coaches, employment
529 coordinators and vocational rehabilitation counsellors, followed by e130 *Products and*
530 *technology for education* representing products such as iPads, tablets, and specifically
531 designed software targeting vocational skills. Concepts relating to (e5) *services, systems and*
532 *policies* described vocational rehabilitation and disability support services assisting individuals
533 with ASD to find and secure employment. It is important to note the linking process aimed to
534 identify those environmental categories associated with employment interventions and
535 processes and did not describe the work environment itself. For example, the code e125
536 *Products and technology for communication* may refer to the use of an iPad by individuals with
537 ASD for communication purposes, but in this context the iPad was used as a tool to deliver an
538 intervention targeting job interview skills (Gentry et al., 2015; Smith et al., 2014). The work
539 environment itself was not modified or influenced to improve employment outcomes.

540 [Insert Table 6 about here]

541 ***Body functions***

542 Two of the eight chapters of the *Body functions* component were represented in the included
543 studies (Table 7). The majority of categories were linked to Chapter 1 *Mental functions*. The
544 most prevalent categories included b122 *Global psychosocial functions*, b177 *Intellectual*
545 *functions*, b140 *Attention functions* and b164 *Higher-level cognitive functions*, all of which

546 included ASD characteristics that are regularly targeted in interventions. This component
547 demonstrated that interventions and programs targeted traits associated with ASD and varying
548 difficulties in the process of preparing, finding and maintaining employment. The most
549 frequently identified category was from the *Body functions* component, b122 *Global*
550 *psychosocial functions*, indicative of the focus on interventions on impairment-related factors.

551 [Insert Table 7 about here]

552 *Consultation with stakeholders*

553 Focus groups were conducted with stakeholders comprising of adults with ASD, parents of
554 individuals with ASD, employers, disability employment coordinators, practitioners and expert
555 researchers. Stakeholders were presented with an opportunity to share their perceived
556 concerns in relation to factors influencing the process of finding and securing a job for adults
557 with ASD. Parents of adults with ASD stated:

558 Success is achieved in the workplace when people have an understanding of ASD and
559 positive experiences with previous employees with ASD.

560 Stakeholders also provided feedback regarding the results of the scoping review. The
561 stakeholders' perceived employment concerns were validated by the findings from the scoping
562 review and confirmed that the work environment plays a critical role in influencing
563 employment opportunities and outcomes for people with ASD. While consultation with
564 stakeholders improved the richness of the research process, further exploration of individual
565 perspectives would likely refine feedback and enhance the translation process given the

566 diversity of the group. Such considerations may be beneficial when conducting future scoping
567 review practices.

568 **Discussion**

569 Given that employment commonly occurs within complex environments, this scoping review
570 used the ICF to enable a structured understanding of the factors contributing to finding and
571 securing employment beyond the diagnosis and functioning levels of individuals with ASD
572 (World Health Organization, 2001). This review found RCT and quasi-experimental evidence to
573 support the effectiveness of employment interventions in adults with ASD in improving
574 vocational skills, executive functioning in relation to job performance and employment status
575 outcomes. Statistically significant improvements were reported for intervention participants
576 compared to control participants across outcomes. While the research is limited, it points to
577 the need for further interventions to be developed and evaluated.

578

579 To date, ASD research has largely focused on diagnosis and early intervention services for
580 children, and as confirmed by the findings of the current review, a paucity of literature has
581 focused on examining the relative effectiveness of interventions in adulthood (Schall et al.,
582 2015; Howlin et al., 2015; Hedley et al., 2016). Of the 134 employment studies identified for
583 inclusion in this review, only 36 were intervention-based. While these interventions studies
584 had the stated collective purpose of improving employment outcomes, they were primarily
585 impairment-focused, targeting their interventions at intrinsic individual ASD characteristics,
586 with little consideration of contextual influences. Interventions targeted ASD traits commonly

587 associated with difficulties in finding and obtaining a job, such as executive functioning skills in
588 relation to problem-solving, organisation, task management and behaviour regulation and
589 social communication skills required in interviews and workplace interactions (American
590 Psychiatric Association, 2013; Hendricks, 2010; Müller et al., 2003). While many of these
591 interventions were effective in increasing measured vocational and executive functioning skills,
592 many participants continued to remain unemployed. The continuing high rates of
593 unemployment among participants following these interventions suggest that impairment-
594 focused interventions alone are not sufficient in achieving and maintaining successful work-
595 related outcomes for individuals with ASD (Ellenkamp et al., 2016).

596

597 One possible explanation to impairment-focused interventions could be the entrenched use of
598 the medical model in underpinning interventions in adulthood. The medical model views ASD
599 as a problem of the individual, requiring them to take responsibility for their disability and
600 make the necessary personal adjustments to be eligible for employment (Dempsey and
601 Nankervis, 2006). While the employment interventions examined in the current study did not
602 require the individual with ASD to take responsibility for their disability, many targeted the
603 associated traits of ASD, and subsequently developed interventions targeted at personal
604 change to assist in eligibility in finding and keeping a job (Bonete et al., 2015; Gilson and
605 Carter, 2016; Liu et al., 2013; Morgan et al., 2014). This was evident when linking employment
606 interventions to the ICF Core Sets for ASD. The greatest number of categories were derived
607 from the *Activities and Participation* component, with interventions targeting core ASD traits
608 such as, communication (d3); learning and applying knowledge (d1) and general tasks and

609 demands (d2), with the outcome of acquiring, keeping and terminating a job (d8).
610 Communication had the greatest number of categories, with more than 50% of interventions
611 targeting the communication skills of individuals with ASD as the focus in improving
612 employment outcomes. The use of impairment-focused interventions was further supported
613 by the *Body functions* component indicating the most frequently targeted mental functions
614 (b1) included intellect (b117); global psychosocial functions (b122) and higher-level cognition
615 (b164) of individuals with ASD. In an attempt to move away from the traditional medical model
616 many interventions have incorporated environmental factors such as, products and technology
617 (e130) and job coaches (e360) in their approach (Allen et al., 2010a; Allen et al., 2010b;
618 Arikawa et al., 2013; Smith et al., 2014). However, these environmental factors have merely
619 been used as a means of delivering impairment-focused interventions, rather than being the
620 intervention itself, i.e., an electronic device (*environmental factor*) is used to assist individuals
621 with ASD in time and task management (*body function-executive functioning*) to improve work
622 performance (activities and participation) (Gentry et al., 2015). The categories identified within
623 the *Environmental factors* component indicated that support from allied health professionals,
624 co-workers and employers (e3), organised support from government-funded services (d5) and
625 products and technology (e1) interact with the employee with ASD and assist in determining
626 their level of functioning in the workplace.

627

628 These findings highlight the usefulness of the biopsychosocial model of the ICF, yet no
629 employment interventions examined in the current study have purposefully incorporated the
630 dynamic interaction between the person and the environment into their design.

631 Conceptualising employment interventions is hampered by the paucity of research addressing
632 intervention design in adults with ASD (Hedley et al., 2016; Holwerda et al., 2012). However,
633 advances such as the publication of the ICF Core Sets for ASD (Bölte et al., 2017) provide an
634 opportunity to not only holistically synthesise the literature relating to employment of
635 individuals with ASD, but develop interventions which consider functioning and disability and
636 contextual factors.

637

638 Viewing individuals with ASD through an impairment-focused lens results in an imbalanced
639 view of ASD and fails to recognise the many strengths and abilities of this group (Armstrong,
640 2010). It is recognised that ASD is associated with many strengths and abilities which could be
641 utilised in work environments (de Schipper et al., 2016). In contrast to the medical model, a
642 strengths-based approach views the positive aspects that an individual brings to the workplace
643 such as their talents, skills and abilities and highlights areas of competence (Steiner, 2011).
644 This perspective promotes opportunity, performance and productivity by harnessing and
645 developing an individual's strengths rather than counteracting their weakness (Russo, 1999;
646 Lorenz and Heinitz, 2014). In this review, only 14 articles considered the skills and abilities of
647 employees with ASD, and the subsequent benefits that these strengths bring to the workplace
648 (Table 3) (Scott et al., 2017). While the skills and abilities of employees with ASD were
649 identified, not a single study utilised a strengths-based approach in improving employment
650 outcomes. Only two of the 14 studies incorporated the skills and abilities of individuals with
651 ASD as part of the job matching process (Hagner and Cooney, 2005; Hillier et al., 2007). If
652 adult-based interventions are to be more effective across the employment process,

653 interventions should be conceptualised based on an integration of these dichotomous models.
654 Given its biopsychosocial underpinnings, the ICF is an approach which is likely to have
655 particular utility in this endeavor (World Health Organization, 2007). Such an integrative
656 approach to intervention development would focus on profiling an individual's barriers and
657 facilitators in acquiring a job and mitigating their weaknesses by promoting and supporting
658 their strengths.

659

660 This review also highlighted the lack of intervention studies considering environmental factors
661 and the key role that they play in facilitating or hindering work participation. Environmental
662 factors are integral in understanding the interaction between individuals with ASD and the
663 work context in which they are employed (Schneidert et al., 2003). While many studies
664 incorporated environmental factors into their interventions, such as employer and co-worker
665 support, the use of job coaches and technology, these factors were simply used as a means in
666 delivering or implementing the intervention targeting ASD characteristics. Of the 32
667 intervention-based studies, not one addressed the environmental factors as the primary target
668 of their intervention. This finding is concerning given the argument that disability can be
669 viewed as a social construct influenced by the environment (Shakespeare, 2013). The social
670 model approach challenges the concept of disability as solely the responsibility of the
671 individual and instead advocates for societal action in removing the barriers and modifying the
672 environment to promote full participation in all major life areas (Dempsey and Nankervis,
673 2006; Shakespeare, 2013). Employers are considered an environmental factor in the
674 employment process, many of which are often in influential positions to hire prospective

675 employees, implement workplace modifications, foster inclusive workplace cultures and
676 employ organisational policies and practices that remove barriers to work participation
677 (Erickson et al., 2014). In addition, the use of natural supports in the work environment
678 encourages co-workers in providing assistance, training and feedback to employees with ASD
679 (Storey, 2003). Natural supports are recognised for their consistency and reliability in the
680 workplace and often result in opportunities for social interaction and inclusion (Mank et al.,
681 1997). Despite their capacity to foster a tailored work environment for employees with ASD,
682 employers and co-workers are an overlooked and underutilised resource.

683 *Clinical implications*

684 Previous medicalisation of the characteristics associated with ASD has resulted in the
685 development of adult-based interventions focusing on impairment, leading to policies and
686 practices targeting individuals rather than the environment and social organisations
687 (Schneidert et al., 2003). This review provides a comprehensive overview of the contextual
688 factors that may be required for improving employment outcomes for individuals with ASD.
689 One such contextual factor are employers, who have previously demonstrated their capacity to
690 provide workplace accommodations (Hernandez et al., 2009; Hartnett et al., 2011). Many
691 employers unknowingly implement a generic approach to disability in the workplace, with a
692 limited knowledge of ASD and the unique needs and accommodations required by this
693 population (Richards, 2012). Employer interventions are needed to address both knowledge
694 and understanding of ASD in the workplace and the skills required in modifying the work
695 environment accordingly. Similarly, disability employment service providers may also benefit
696 from such education-based interventions, as education is critical in empowering behaviour

697 change and management (Daniali et al., 2016). Further consideration of contextual factors may
698 include the use of natural support such as supervisors and co-workers to assist employees with
699 ASD in completing work-related tasks, providing feedback and socialising by facilitating their
700 job performance in the workplace (Storey, 2003). This may be achieved by providing ASD-
701 specific education training and peer-mentoring programs to upskill supervisors and co-
702 workers, increasing their awareness and understanding of ASD. Training programs are most
703 likely to be cost-effective, time-efficient and easily implemented. Given the many benefits of
704 peer-support in school-based environments for children and adolescents, such as positive
705 behaviour change, increased cognitive, affective and social communication skills, inclusion and
706 a sense of well-being (McCurdy and Cole, 2014; Locke et al., 2012; Schlieder et al., 2014), this
707 approach is likely to be equally beneficial when effectively translated into the work
708 environment.

709 *Research gaps and future directions*

710 This scoping review reveals several gaps in the literature. The majority of included studies did
711 not use standardised outcome measures when evaluating employment outcomes, many of
712 which were descriptive and observational in nature or designed specifically for a particular
713 study without further validation. The findings from this review revealed a significant lack of
714 reliable and valid measures assessing employment intervention outcomes for adults with ASD
715 (Howlin et al., 2015). In order to address this issue, there is a need to explore and define what
716 constitutes as a successful employment outcome for adults with ASD (Taylor, 2017). While the
717 heterogeneity associated with ASD will make the process of defining employment success
718 challenging, there will most likely be consensus in relation to the broader definitions of certain

719 outcomes including employment status, job satisfaction and engagement, financial gain and
720 career growth and development. A better understanding of an individual's perceived quality of
721 life as a result of employment may be a more effective way of capturing and unpacking
722 success.

723 *Limitations*

724 There were several limitations associated with this review. Firstly, the inclusion criteria defined
725 that only English text studies were to be included in this review, of which the majority
726 represented a US-based perspective on employment outcomes for individuals with ASD. The
727 lack of inclusion of non-English studies and an unequal representation across countries may
728 present a biased view on the factors impacting employment outcomes. Next, given that
729 adulthood and employment in ASD is an emerging area of research, much of the ASD
730 employment literature that exists is either at a national level under the broader umbrella of
731 disability, with many resources, services and programs lacking scientific rigour and an
732 evidence-based approach in their development and implementation. Lastly, while a meta-
733 analyses of the included studies would have increased the statistical power and enhanced
734 estimates of the effect size of employment interventions, given the variability in outcomes and
735 diffuse nature of the literature, this was not possible (Fagard, 1996).

736 **Conclusion**

737 This scoping review demonstrated the utility of the ICF as a comprehensive framework in
738 reviewing and synthesising the employment literature in relation to the outcome measures
739 used, the identified skills and abilities that individuals with ASD bring to the workplace, and the

740 overall outcomes of employment interventions and programs. This review also promoted a
741 more balanced approach in working with adults with ASD, encouraging the consideration of
742 contextual factors, both environmental and personal, and their potential to influence work
743 participation. It is imperative that future research acknowledges the defined gaps in this
744 review, amending future practices and research designs.

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Tables

Table 1. Search terms^a

Diagnosis	Age	Intervention	Outcome
autis*, autism spectrum disorder, asperger*, pervasive development* disorder*, autistic disorder*	adult*, adolescent*, youth, young adult*	support*, service, program, training, vocation* rehabilitation provider, strategy, intervention, accommodation*, employer*, supervisor*, manager*, environment*	employ*, work*, job, vocation*, occupation*, participation, competitive employ*, supported employ*, sheltered employ*

^aTerms were connected with 'OR' and between terms with 'AND'

*Search terms truncated and exploded

Table 2. Descriptive characteristics of general articles relating to employment outcomes ($k=98$)

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage			Quality and level of evidence
				W/I/VT	S	SE	C	P	S	M	
Alverson et al., 2017, USA	Retrospective observational study using national database	Individuals diagnosed with ASD who were clients of VR services in the USA; N=49,623 (81% - 84% male from 2003 to 2012).	Using a database description of employment outcomes relating to: highest level of education attained at client's application, individual education plan status, employment status at application and case closure, total services received.				X		•		Strong (18/22) III
Anderson et al., 2017, Australia	Systematic review	Individuals diagnosed with ASD; N=62 (58 males, 4 females), Age: 14-42 years.	Quality and methodological assessment of evidence, classification of studies and treatment effects and replication standards	X	X	X	X	•			Strong (19/20) II
Andersson et al., 2015, Sweden	Online vignette study	Employers with hiring responsibilities N=212 (109 females, 100 males); Age: $M=45$ (11.47)	Questionnaire on employers' attitudes towards persons with various disabilities				X	•			Strong (19/22), V
Autism Europe, 2014, Czech Republic	Report	Individuals diagnosed with ASD	N/A		X	X		•	•	•	Limited (5/20), N/A
Autism Speaks, 2012, USA	Descriptive report	Stakeholders including individuals with ASD, family members, VR counsellors, service providers, academic experts and business leaders and entrepreneurs.	N/A				X		•	•	Limited (0/20), V
Autism Spectrum Australia, 2013, Australia	Online cross-sectional survey	Individuals diagnosed with AS or HFA; N=313 (71% male, 29% female); Age: $Mdn=30$ years (18-70 years)	Questionnaires profiling the experiences, needs and aspirations of adults with AS/HFA				X			•	Good (15/20), N/A
Baldwin et al., 2014, Australia	Online cross-sectional survey	Individuals diagnosed with AS, HFA, ASD or PDD-NOS; N=130 (88 males, 42 females); Age: $M=35.6$ (12.4)	Questionnaire on employment outcomes relating to: Type of occupation, occupational skill level, hours of work, type of job contract, workplace support, employment experiences				X			•	Strong (16/20), IV
Briel et al., 2014., USA	Structured interviews	Individuals diagnosed with ASD; N=18 (18-43 years; 15 males, 3 females)	Two-part interview instrument including demographic data and 7 open-ended questions	X				•			Adequate (13/20), V
Burgess and Cimeria, 2014, USA	Case report database analysis	Individuals diagnosed with ASD; N=34, 501 (82.2% male, 17.8% female); Age: $M= 20.32$ years	Using a dataset description of employment outcomes relating to: successful employment, hours worked, wages earned, costs of services				X			•	Good (15/22), III

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage			Quality and level of evidence	
				W/I/VT	S	SE	C	P	S	M		
Bush and Tassé, 2017, USA	Retrospective observational study using national database	Individuals diagnosed with ASD; N=2174 (76.7% male, 23.3% female), Age: M=34.53 (SD: .12.61) years Individuals with Down syndrome; N=1857 (53.9% male, 46.1% female), Age: M=40.87 (SD: .12.03) years Individuals with idiopathic intellectual disability; N=15,845 (54.3% male, 45.7% female), Age: M=44.77 (SD: 15.10) years	Using database description of employment factors relating to: demographic factors and ability to make 'choices' (such as choosing where you live, choosing case manager).		X		X		•		Strong (22/22) III	
Capo, 2001, USA	Case study	Individual diagnosed with ASD; N=1 (22-year-old female)	Self-report				X		•	•	Limited (7/20), IV	
Chen et al., 2015a, USA	Narrative literature review	Individuals diagnosed with ASD	N/A				X			•	Limited (9/20), IV	
Chen et al., 2015b, USA	Case report database analysis	Individuals diagnosed with ASD; N= 5681 Transition group: n=2718 (18 years or younger; 2290 males, 428 females) Transition young adults: n=2162 (19-25; 1812 males, 349 females) Adults: n=801 (26 years and older; 669 males, 132 females)	Using a dataset description of employment outcomes relating to: employment status, hourly wages, hours worked, association of demographic covariates, success of rehabilitative services				X		•	•	•	Strong (15/18), IV
Cimera and Cowan, 2009, USA	Retrospective observational study	Individuals diagnosed with ASD; N= 11, 569 (80.3% males, 19.7% females); Age: M=28.8	Using a dataset description of employment outcomes relating to: cost of services, changes in wages earned and hours worked, successfully or unsuccessfully employed, conversion to dollar values					X			•	Good (14/18), III
Cimera and Burgess, 2011, USA	Retrospective observational study	Individuals diagnosed with ASD; N=19,436 (80.4% male, 19.5% female); Age: M=25.2	Using a dataset description of employment outcomes relating to: employment status, hours worked, wages earned, taxes paid, forgone wages, subsidies received, cost-efficiency, conversion to dollar values				X			•	•	Good (14/18), III
Cimera et al., 2012, USA	Case-control study	Individuals diagnosed with ASD; N=530 Sheltered: n=215 (80% males, 20 females); Age: M= 31.12 (9.07) Non-sheltered; n=215 (80% males, 20% females); Age: M=37.75 (8.9)	Using a dataset description of employment outcomes relating to: disabilities, rate of employment, wages earned, hours worked, cost of services		X				•			Good (14/18), IV

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage		Quality and level of evidence
				W/I/VT	S	SE	C	P	S	
Ditchman et al., 2017, USA	Network analysis using a national database	Individuals with ASD receiving VR services in the USA; N=2,129 (1,794 males, 335 females). Age: M=18.55 (SD:192) years	Using database description of employment factors relating to: demographics, employment outcomes and VR services received.				X		•	Strong (22/22) III
Foley and Staples, 2003, USA	Case study	Individuals diagnosed with ASD and ID; N=3 (22-35 years, all male)	Caregivers and staff communication needs survey, adapted measures for phonemic awareness, knowledge of letter sound, word identification, text comprehension and developmental spelling, parts of the Test of Early Reading Ability (TERA)					X	• • •	Adequate (11/20), IV
Gal et al., 2015a, Israel	Case-control study	Individuals diagnosed with HFASD and individuals without disabilities, N=139 With HFASD: n=37 (30 males, 7 females); Age: M=25.37 (6.94) Without HFASD: n=102 (77 males, 25 females); Age: M=24.71 (4.79)	Autism Work Skills Questionnaire (AWSQ)				X		•	Strong (16/20), II
Gal et al., 2015b, Israel	Pretest-posttest study	Individuals diagnosed with AS, ASD or PDD-NOS; N=25 (24 males, 1 female); Age: M=19.08	Quality of Life questionnaire (QOL-Q); Personal Wellbeing Index (PWI)	X					• •	Adequate (15/22), II
Garcia-Villamizar et al., 2002, Spain	Quasi-experimental	Individuals diagnosed with ASD; N=55 Sheltered: n=26 (18 males, 8 females) Age: M=21.07 (4.18) Supported: n=25 (21 males, 4 females); Age: M=21.64 (3.75)	Quality of Life Survey (QLS)		X	X			•	Strong (19/22), III
Garcia-Villamizar and Hughes, 2007, Spain	Pretest-posttest study	Individuals diagnosed with ASD; Supported employment group: N=44 (32 males, 12 females); Age: M=25.52 (3.35) Control: sample not reported except for age: M=24.32 (4.34)	Cambridge Neuropsychological Tests: Automated Battery (CANTAB), Trail Making Test, Matching Familiar Figures Test, The Word Fluency Test			X			•	Strong (16/20), III
Gladh and Sjölund, 2014, Sweden	Pilot intervention evaluation	Individuals diagnosed with ASD	Self-assessment			X	X		•	Adequate (10/20), IV
Griffith et al., 2012, Wales	Semi-structured interviews	Individuals diagnosed with or self-reporting AS; N=11 (7 males, 4 females) Age: M=46.36 (7.17)	Interview question guide developed based on a literature review				X		•	Good (14/20), V

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment			Employment stage		Quality and level of evidence					
				W/I/VT	S	SE	C	P		S	M			
Hagner and Cooney, 2005, USA	Semi-structured interviews	Supervisors of employees with autism; N=14, age and gender not reported	Interview question guide developed based on a literature review of employment support services				X		•	•	Adequate (11/20), V			
Hayward et al., 2018, Australia	Systematic review	Individuals with ASD; N=731 (n=229 females), Age: M=34.38 (7.71)	Effect sizes, outcomes and descriptive analysis					X		•	•	Adequate (13/20) IV		
Hedley, 2016, Australia	Systematic review	Individuals diagnosed with ASD; N= 58,134 Qual: n=59 (91% males, 9% females); Age: M=24.84 (5.93) Quant: n=717 (79% males, 21 females); Age: M=24.24 (4.32) Database: n= 57, 172 (80% males, 20% female); Age: M=27.46 (7.73) Mixed: n=186 (74% males, 26% females); Age: M=27.93 (6.54)	Coding for background information						X	X	•	•	•	Adequate (12/18), I
Hendricks, 2010, USA	Narrative literature review	Individuals diagnosed with ASD	N/A						X	X	•	•	•	Limited (8/20), V
Higgins et al., 2008, USA	Narrative literature review	Individuals diagnosed with AS	N/A						X			•	•	Limited (7/20), V
Holwerda et al., 2012, Netherlands	Systematic review	Individuals diagnosed with ASD; Gender and age not reported	Quality and methodological assessment				X	X	X				•	Good (14/18), I
Holwerda et al., 2013, Netherlands	Cross-sectional study	Individuals diagnosed with ASD; N=563 (401 males, 162 females); Age: M=19.4 (2.4)	Using a database description of employment predictive factors relating to: demographics, self-esteem, self-knowledge, motivation, work expectations, living situation, perceived support, attitudes of parents regarding work, attitudes of social environment					X				•	•	Good (14/20), III
Howlin, 2000, UK	Review of longitudinal follow-up studies	Individuals diagnosed with HFA; N=123 (18 years and older; 86% males, 14% females)	N/A				X	X	X				•	Limited (8/20), IV
Howlin et al., 2004, UK	Longitudinal follow-up study	Individuals diagnosed with ASD; N=68 (61 males, 7 females); Baseline age: M=7.24 (3.1) Follow-up age: M=29.33 (7.97)	Autism Diagnostic Interview (ADI)-social functioning, standardised interview schedules, parental questionnaire, Wechsler Adult Intelligence Scale-Revised (WAIS-R)				X	X	X				•	Strong (18/22), III

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage		Quality and level of evidence
				W/I/WT	S	SE	C	P	S	
Howlin et al., 2005, UK	Longitudinal follow-up study	Individuals diagnosed with AS or ASD; Participants-n=114 (male: female ration 4.2:1); Age: <i>M</i> =31.4 (9.3) Line manager: n=63 Employers: n=61 Prospects program staff: n=15 Age and gender not reported	Descriptions of employment outcomes relating to: number and type of jobs, cost-benefit analysis Participants (individuals with ASD), line managers, employers and staff interviewed on Prospects program experience			X				Strong (16/20), III
Howlin and Moss, 2012, UK	Narrative literature review	Individuals diagnosis with AS, ASD or PDD-NOS; N=1561 (16-57 years); gender not reported	Adapted adult functioning rating adopted				X		•	Limited (9/20), IV
Hurlbutt, 2004, USA	Semi-structured interviews	Individuals diagnosed with AS; N=6 (25-65 years; 3 males, 3 females)	Interview question guide regarding employment experiences				X		•	Good (14/20), IV
Järbrink et al., 2007, Sweden	Structured interviews	Individuals diagnosed with ASD; N=19 (84% male); Age: <i>M</i> =29.6	Client Service Receipt Inventory			X	X		•	Adequate (10/20), III
Johnson and Joshi, 2016, USA	Two-part study: Study 1: semi-structured interviews Study 2: online survey	Individuals diagnosed with ASD; Study 1: N=30 (24-58 years, gender not reported) Study 2: N=210 (64% male, 36% female); Age: <i>M</i> =31 (11.4)	Study 1: Interview question guide regarding work-related responses to ASD diagnosis Study 2: Online survey relating to implications of an ASD diagnosis for workplace well-being				X		•	Strong (16/20), V
Katz et al., 2015, Israel	Follow-up study	Individuals diagnosed with HFASD; N=26 (24 males, 2 females); Age: <i>M</i> =29.1 (5.4)	Work Performance Evaluation (WPE), QOL-Q				X		•	Strong (17/20), II
Kaya et al., 2016, USA	Retrospective observational study using national database	Individuals diagnosed with ASD who were clients of VR services in the USA; N=4,332 (84.7% male, 15.3% female), Age: 16-25 years.	Using a database description of employment factors relating to: demographic factors and VR services provided.				X		•	Strong (20/20) III
Kaya et al., 2018, Turkey	Quantitative correlational design using national database	Individuals diagnosed with ASD who clients of VR services in the USA; N=3,243 (83.1% male, 16.9% female), Age: 19-25 years.	Using database description of factors relating to demographics, employment outcomes and VR services received.				X		•	Strong (20/20) III
Keel et al., 2015, USA	Retrospective cohort study	Individuals diagnosed with ASD or PDD-NOS; N=100; Age: <i>M</i> =25; gender not reported	Descriptions of employment outcomes relating to: type of job, hours worked per week, wages earned and job retention			X			•	Adequate (11/20), V
Krieger et al., 2012, Switzerland	Semi-structured interviews	Individuals diagnosed with AS; N=6 (30-45 years; 4 males, 2 females)	Thematic interview question guide relating to contextual factors impacting successful employment				X		•	Strong (20/22), V

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment			Employment stage		Quality and level of evidence	
				W/I/VT	S	SE	C	P		S
Lattimore et al., 2002, USA	Multiple probe baseline study	Individuals diagnosed with ASD; N=3 (25-29 years, all male)	Prework assessment, number of preferred tasks selected			X		•	Limited (6/20), II	
Lattimore et al., 2003, USA	Multiple probe baseline study	Individuals diagnosed with ASD: N=5 (all male); Age: M=30	Prework assessment, on-the-job preference assessment			X		•	Adequate (12/20), II	
Lawer et al., 2009, USA	Routine data-based study, case-control design	Individuals diagnosed with ASD; N= 1707 (18-65 years, 84% males, 16 females)	Using a database description of employment outcomes relating to: access to services, cost of services, competitive employment			X		•	•	Strong (20/22), IV
Lopez and Keenan, 2014, UK	Online survey	Individuals diagnosed with ASD, carers, practitioners; Individuals with ASD: n=46 (31 males, 15 females); Age: M= 39.7 (13.1) Carers: n=36 (5 males, 31 females); Age: M=53.33 (10.67) Practitioners including therapists, clinicians, educators, support workers, advisors: n=38 (8 males, 30 females); Age: M=44 (11.26)	Questionnaires collecting data on demographics, employment history, training				X	•	•	Adequate (12/20), IV
Lorenz et al., 2016, Germany	Online survey	Individuals diagnosed with ASD; N=66 (29 males, 36 females, 1 other); Age: M=35.96 (10.22)	Qualitative questionnaire with 28 open-formatted questions including the General Self-Efficacy Scale, Occupational Self-efficacy, Satisfaction with Life Scale, job satisfaction using a Likert scale				X	•	•	Strong (16/20), III
Lugas et al., 2010, USA	Retrospective observational study	Individuals diagnosed with ASD; N=3323 (16-26 years, gender not reported)	Using a database description of employment outcomes relating to: services received, employment status			X		•	•	Adequate (11/20), III
Mank et al., 1997, USA	Correlation study	Individuals diagnosed with a disability including ASD; N=462, (18-50 years, 59.1% males, 40.9% females) (ASD n=10)	Survey relating to outcomes and features to supported employment including job title, hours worked, wages, benefits, accommodation, worksite characteristics, typicalness of employment situation			X			•	Strong (20/20), IV
Mavranzouli et al., 2013, UK	Retrospective observational study	Individuals diagnosed with ASD without ID; N=50 (age and gender not reported)	Quality-Adjusted Life Year (QALY), description of cost data relating to: vocational rehabilitation services provided including potential accommodation savings and other NHS costs			X		•	•	Strong (17/18), IV
McDonough and Revell, 2010, USA	Narrative literature review	Individuals diagnosed with ASD; N=2 case studies (22-27 years, both male)	Situational assessments			X	X	•	•	Limited (9/20), IV

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage			Quality and level of evidence
				W/I/VT	S	SE	C	P	S	M	
McMahon et al., 2012, USA	Cohort study with a control group	Individuals diagnosed with ASD and ID; ASD group: n=170 (77.6% males, 22.4% females); Age: M=33 ID group: n=1459 (65.3% males, 34.7% females): Age: M=36	Using a database description of workplace discrimination allegations relating to: profiles, low number of cases, age, gender, industry				X		•	•	Good (15/20), IV
Migliore et al., 2012a, USA	Retrospective observational study	Individuals diagnosed with ASD; N=6952 (16-26 years, gender not reported)	Using a database description of employment outcomes relating to: number of individuals receiving services, rehabilitation rate, wages per hour and work hours				X		•		Limited (9/20), III
Migliore et al., 2012b, USA	Retrospective observational study	Individuals diagnosed with ASD; N= 2913 (16-26 years, gender not reported)	Using a database description of transition outcomes and predictors relating to VR services received including gaining integrated employment, hourly earnings, weekly work hours and post-secondary education improvement				X		•		Strong (16/20), IV
Migliore et al., 2014, USA	Correlation study using a national database	Individuals diagnosed with ASD; N= 6952 (16-26 years, gender not reported)	Using a database description of employment outcomes relating to: number of youth existing VR services, receiving services, rehabilitation rates, earning and work hours			X	X			•	Strong (17/20), III
Morgan and Schultz, 2012, USA	Narrative literature review	Individuals diagnosed with ASD; N=1 case study (19-year-old male)	Job-task assessment, social network assessment			X	X		•	•	Adequate (10/20), IV
Müller et al., 2003, USA	Semi-structured interviews	Individuals diagnosed with AS or ASD; N=18 (18-62 years; 13 males, 5 females)	Interview protocol on strategies for improving vocational placement and job retention services				X		•	•	Adequate (12/20), V
Müller and Vangilder, 2014, USA	Follow-up study	Individuals diagnosed with a disability including ASD; N=10 (17-24 years; 6 males, 4 females); ASD n=4	Developed a Job Readiness Assessment Tool (JRAT), 3 brief interview protocols regarding perceptions of participants' growth and ongoing challenges in the study				X		•		Good (17/22), II
Nesbitt, 2000, UK	Cross-sectional questionnaire	Organisations employing adults with AS; N=69; no age or gender reported	Developed questionnaire according to support needs and employment process			X			•		Adequate (12/20), III
Nicholas et al., 2014, Canada	Narrative literature review	Individuals diagnosed with AS; 18 years and older	N/A			X	X		•	•	Strong (20/20), IV

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage			Quality and level of evidence
				W/I/VT	S	SE	C	P	S	M	
Nicholas et al., 2017a, Canada	Qualitative analytic Focus groups	Individuals with ASD, family members, researchers, program and policy developers, practitioners, and interdisciplinary ASD trainees; N=120	Qualitative description analysis	X		X	X	•	•	•	Strong (16/20) V
Nicholas et al., 2017b, Canada	Mixed methods	Survey: senior clinicians and administrators of employment support programs; N=137 Qualitative interviews: Individuals with ASD, AS or PDD-NOS; N=71 (69% male, 31% female), Age range 18-65 years Parents/caregivers.; N=51	Survey: Likert scale responses relating to capacity to meet vocational needs, enhancing systems capacity, service planning and evaluation and community capacity Qualitative interviews: line by line coding and thematic analysis.				X	•	•	•	Strong (20/22) III
Nord et al., 2016, USA	Retrospective observational study	Individuals with and without ASD; ASD group: n=977; Age: M=33.94 (12.36) Without ASD group: n=7992; Age: M=41.42 (11.4) gender not reported	Using a dataset description of employment outcomes relating to community employment, diagnosis, age, behaviour, health, mobility				X		•	•	Strong (22/22), III
Nye-Lengerman, 2017, USA	Retrospective observational study using national database	Individuals diagnosed with ASD who were clients of VR services in the USA; N=10,209 (83.6% male, 16.4% female), Age: M=21.57 (SD: 7.13) years	Using a database description of employment factors relating to: demographic factors and VR services provided.				X		•		Strong (20/22) III
Ohl et al., 2017, USA	Cross-sectional survey	Individuals with AS; N=254 (55.12% males, 43.31% female), Age: M= 38.11 (SD: 13.02) years Employed subgroup; n=156 (59.48% male, 40.52% female), Age: M=38.87 (SD:12.97) years Unemployed subgroup: n=98 (50.52% male, 49.48% female), Age: M=36.93 (SD: 13.07) years	ASD Employment Questionnaire (ASDEQ), Short Effort-Reward Imbalance Questionnaire (ERI)				X		•	•	Strong (22/22) III

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage		Quality and level of evidence	
				W/I/VT	S	SE	C	P	S		M
Parr and Hunter, 2013, USA	Semi-structured interviews	Individuals diagnosed with ASD; N=54 (46.3% males, 53.7% females)	Interview question guide, five-point Likert scale of leadership behaviours work outcomes measured using 7-point Likert scales, 3-items from Michigan Organizational Assessment Questionnaire, organisational commitment using 8-items from the Affective Commitment Scale, work engagement using 6-items from Utrecht Work Engagement Scale				X		•	•	Good (20/26), V
Pillay and Brownlow, 2016, Australia	Systematic review	Individuals diagnosed with ASD; N= 3984 (16-55 years)	Quality Appraisal Checklist					X	•	•	Strong (18/20), I
Rashid et al., 2017, Canada	Synthesis review	Individuals with developmental disability, including ASD	Content analysis			X	X		•	•	Strong (18/20) II
Richards, 2012, UK	Qualitative database study	Individuals diagnosed with AS; Age and gender not specified	Using the database descriptions of exclusion processes relating to selection procedures, people management, physical and social environment, employer resistance to accommodations				X			•	Adequate (12/20), V
Rosqvist and Keisu, 2012, Sweden	Qualitative review	Individuals diagnosed with ASD; Sample size, gender and age not reported	Thematic coding de-constructing the notion of 'real jobs'				X		•	•	Limited (9/20), V
Roux et al., 2013, USA	Cross-sectional survey national database prospective longitudinal study	Individuals diagnosed with ASD; N=620 (85% males); Age: M=23.2	Using the database description of employment outcomes relating to: employment status, job type, number of jobs since high school and wages earned, functional skills 4-point Likert scale				X			•	Strong (20/22), III
Roux et al., 2015, USA	Cross-sectional survey national database prospective longitudinal study	Individuals diagnosed with ASD; 21-25 years; 80% males	National Longitudinal Transition Study-2 questionnaire relating to adult outcomes, health, post-secondary education, employment, living arrangements, social and community participation and safety and risk			X	X		•	•	Limited (9/24), N/A
Schall et al., 2015, USA	Retrospective observational records review	Individuals diagnosed with ASD; N=45 Project Search group: n=25 (18 males, 7 females); Age: M=23.12 (1.13) SE group: n=20 (19 males, 1 females); M=29.05 (10.95)	Individual employment records relating to intake, hourly billing, employment notes, employment outcomes, number of intervention hours, time in job, wages earned				X			•	Strong (18/20), III

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment			Employment stage		Quality and level of evidence					
				W/I/VT	S	SE	C	P		S	M			
Schaller and Yang, 2005, USA	Correlation study using a national database	Individuals diagnosed with ASD; C: <i>n</i> =450 (84.2% males); Age: <i>M</i> = 25.3 (7.69) SE: <i>n</i> =365 (87.9% males); Age: <i>M</i> = 27.3 (7.23)	Using a database description of employment outcomes relating to: successful or unsuccessful close of VR support plan, case service cost, hours worked per week and weekly wages earned				X			Strong (20/20), III				
Scott et al., 2015, Australia	Q sort method	Individuals diagnosed with ASD and their employers; ASD: <i>n</i> =40 (24 males, 16 females); Age: <i>M</i> = 29.1 (10.7) Employers: <i>n</i> =35 (16 males, 19 females); Age: <i>M</i> =44.6 (10.4)	Q sort pack including concourse statements developed from the literature and Q sort grid						X	•	•	•	Strong (20/20), III	
Seaman and Cannella-Malone, 2016, USA	Narrative Literature review	Individuals diagnosed with ASD; N=203 (13-60 years; 178 males, 25 females)	Quality and methodological assessment of evidence	X							•		Strong (17/20), V	
Shattuck et al., 2012, USA	Correlational study using national database prospective longitudinal study	Individuals diagnosed with ASD; ASD: <i>n</i> =680 (19-23 years; 86.9% males, 13.1% females)	Questionnaire relating to participation in postsecondary education and paid employment, length of time in high school, health, functional independence skills					X			•	•	Strong (18/20), III	
Shattuck et al., 2015, USA	Narrative literature review	Individuals diagnosed with ASD; N=14,392 (18-65 years; 83% males)	N/A						X		•	•	Strong (20/20), V	
Smith et al., 2015, USA	Follow-up survey	Individuals diagnosed with HFASD; N=23 VR-JIT: <i>n</i> =15 (73.3% males); Age: <i>M</i> =25 (6.9) Control: <i>n</i> =8 (75% males); Age: <i>M</i> =23.1 (3.3)	Bell-Lysaker Emotion Recognition Task (BLERT), Social Responsiveness Scale (SRS), self-confidence 7-point Likert scale, process measures including: change in job role-play performance, number of virtual VR-JIT trials completed and changes in VR-JIT performance across trials							X		•	Strong (18/20), V	
Smith et al., 2017, USA	Systematic review	Individuals with disabilities, including ASD	Level of evidence, risk bias	X	X	X	X		•		•	•	Strong (19/20), I	
Stuckey, 2016, USA	Online survey	Business executives in a hiring role; N=157 (97 males, 54 females, 6 other); age not reported	Online 14-item survey on knowledge of ASD					X				•	•	Strong (18/18), IV

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage			Quality and level of evidence
				W/I/VT	S	SE	C	P	S	M	
Sung et al., 2015, USA	Case report database analysis	Individuals diagnosed with ASD; N=1696 (16-25 years; 857 males, 839 females)	Using a database description of employment outcomes relating to employment status at VR case closure, predictors including demographic characteristics, work incentives and VR services				X		•	•	Strong (20/20), IV
Taylor and Seltzer, 2011, USA	Cross-sectional subsample from a prospective longitudinal study	Individuals diagnosed with ASD; N=66 (80% males); Age: M=22.98 (1.51)	Adult day activities, Wide Range Intelligence Test, family income, ADI-Revised (ADI-R), Scales of Independent Behaviours-Revised (SIB-R) completed by mothers, revised Activities of daily living (ADL) Index		X	X	X		•		Strong (20/20), IV
Taylor et al., 2012a, USA	Systematic review	Individuals diagnosed with ASD; 13-30 years, gender not reported	Quality and methodological assessment of evidence				X		•	•	Strong (18/20), I
Taylor and Seltzer, 2012b, USA	Cross-sectional subsample from a prospective longitudinal study	Individuals diagnosed with ASD N=343 (73% males); Age: M=22.84 (9.58)	Descriptive profiling including: weekly participation in vocational or educational activities, numbers of hours of participation, job history	X	X	X	X		•	•	Strong (17/18), III
Taylor, 2014, USA	Longitudinal follow-up study	Individuals diagnosed with AS, ASD, or PDD-NOS; N=161 (72% males); Age: M=30.9 (8.3)	The Vocational Index, parents completed Behaviour Problems subscale of the SIB-R, ADI-R, residential status, demographic characteristics			X			•	•	Strong (19/20), III
Taylor et al., 2015, USA	Longitudinal correlational study	Individuals diagnosed with ASD; N=73 (79.5% males); Age: M=23.83 (6.83)	The Vocational Index, demographic characteristics, behavioural indices from Time 1 in longitudinal study, Waisman ADL Scale (W-ADL), subscale of the SIB-R, ADI-R, family indices including mother's support network, maternal depressive symptoms Centre for Epidemiological Studies-Depression Scale, maternal anxiety using the Anxiety subscale of the Profile of Mood States and maternal pessimism using the Pessimism scale of the Questionnaire on Resources and Stress				X		•	•	Strong (18/18), III
Van Wieren et al., 2008, USA	Cohort study with a control group	Individuals diagnosed with ASD and other disabilities including physical, sensory or neurological; ASD group: n= 98 (72 males, 26 females); Age: M= 36 Disability group: n=174,330 (54.7% males, 45.3% females); Age: M=44	Description of demographic characteristics, industry type, number and type of allegations				X		•	•	Strong (19/20), IV

Table 2. Continued

Author, year, country	Design	Participants	Outcome measures	Type of employment				Employment stage			Quality and level of evidence
				W/I/VT	S	SE	C	P	S	M	
Vogeley et al., 2013, Germany	Narrative literature review	Individuals diagnosed with HFASD; Sample, gender and age not reported	N/A			X			•	•	Limited (0/20), V
Walsh and Hall, 2012, UK	Critical review report	Individuals diagnosed with ASD; Sample size, gender and age not reported	Descriptively critiqued equity, integration, implementation and diagnosis and specialist interventions services for individuals with ASD			X	X		•	•	Limited (0/20), V
Walsh et al., 2014, Ireland	Narrative literature review	Individuals diagnosed with AS, ASD or PDD-NOS; N=78 (13-30 years; 72.2% males)	N/A				X		•	•	Strong (18/20), V
Wehman et al., 2014, USA	Narrative literature review	Individuals diagnosed with ASD; Sample size, gender and age not reported	N/A				X		•	•	Limited (2/20), V
Wehman et al., 2016a, USA	Retrospective records review	Individuals diagnosed with ASD; N=64 (52 males, 12 females); Age: M=26	Description of employment outcomes relating to: employment rate, job type, wages and benefits earned, weekly work hours, supports used, intervention time				X		•	•	Strong (16/18), V
Wei et al., 2015, USA	Cross-sectional subsample from a prospective longitudinal study	Individuals diagnosed with ASD; N=120 (15-18 years; 86.6% males)	Six survey items, parents answered employment-related questions and demographic characteristics				X		•	•	Strong (16/18), III
Westbrook et al., 2012, USA	Systematic review	Individuals diagnosed with ASD; N=101 gender and age not specifically reported	Quality and methodological assessment of evidence				X		•	•	Strong (18/20), II
Whetzel, 2014, USA	Narrative literature review	Individuals diagnosed with ASD; Sample size, gender and age not reported	N/A				X		•		Limited (0/20), V
Wilczynski et al., 2013, USA	Narrative literature review	Individuals diagnosed with ASD;	N/A				X		•	•	Limited (0/20), V

Note. W/I/VT: Work experience or internship or vocational training; S: Sheltered employment; SE: Supported employment; C: Competitive employment
P: Preparing for employment; S: Seeking or securing employment; M: Maintaining employment
ASD: Autism spectrum disorder; AS: Asperger’s syndrome; HFASD: High functioning ASD; PDD-NOS: Pervasive developmental disorder not-otherwise specified, according to the DSM-IV (American Psychiatric Association, 2000); ID: intellectual disability
M: Mean; Mdn: Median; Qual: Qualitative; Quant: Quantitative
ADL: Activities of Daily Living; NHS: National Health Services; VR: Vocational Rehabilitation; VR-JIT: Virtual reality job interview training
TERA: Test of Early Reading Ability; AWSQ: Autism Work Skills Questionnaire; QOL-Q: Quality of Life Questionnaire; PWI: Personal Well-being Index; QLS: Quality of Life Survey; CANTAB: Cambridge Neuropsychological Tests Automated Battery (CANTAB); ADI-R: Autism Diagnostic Interview Revised; WAIS-R: Wechsler Adult Intelligence Scale Revised; WPE: Work Performance Evaluation; QALY: Quality Adjusted Life Year; JRAT™ Job Readiness Assessment Tool; BLERT: Bell-Lysaker Emotion Recognition Test; SRS: Social Responsiveness Scale; SIB-R: Scales of Independent Behaviour Revised;
W-ADL: Waisman Activities of Daily Living Scale

Table 3. Article contribution to ASD-related skills and abilities in employment

Author and year	ASD-related skills and abilities ^a														
	Attention to detail	Other	Strong sense of morality	Intellectual functions	Technical abilities	Trustworthiness	Repetitive or monotonous tasks	Artistic skills	Visual perception	Good memory	Expertise in a specific area	Creative talents	Loyalty	Mathematical abilities	Kindness
Baldwin et al., 2014					•			•							
Briel and Getzel, 2014						•		•	•			•			
Burt et al., 1991									•						
Gal et al., 2015a	•	•					•								
Garcia-Villamizar and Hughes, 2007				•						•					
Hagner and Cooney, 2005	•	•				•				•					
Ham, 2014	•							•		•		•			
Hillier, 2007	•	•	•		•	•					•		•		
Holwerda et al., 2012				•											
Mawhood and Howlin, 1999	•	•	•												
Müller et al., 2003	•	•			•				•		•			•	
Müller and Vangilder, 2014	•	•	•		•	•	•						•		•
Stuckey, 2016	•	•	•	•											
Wehman et al., 2013				•			•								

^aASD-related skills and abilities list taken from de Schipper et al. (de Schipper et al., 2016)

Table 4. Descriptive characteristics of employment program and intervention studies ($k=36$) linked to the ICF

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Allen et al., 2010a	Multiple baseline across participants	Individuals diagnosed with AS or PDD-NOS; N=3 (17-22 years, all male)	Observation of vocational skill acquisition; partial interval recording system	<u>Vocational skills</u> A 30% increase in acquisition and retention of targeted vocational skills post VM	W/I/VT	P	Adequate (11/22), II	Second level: b117, b122, b130, b760, d160, d220, d825, e125, e130 Third level: b1300, b1301, b1304, b7600, b7601, b7602, d2200, d2201, d2202, d2204, d8250, d8251, e1250, e1300
Allen et al., 2010b	Multiple baseline across participants	Individuals diagnosed with AS, ASD or PDD-NOS; N=4 (16-25 years, all male)	Observation of vocational skill acquisition; partial interval recording system	<u>Vocational skills</u> Participants learned to use targeted skills after watching VM	W/I/VT	P	Adequate (11/22), II	Second level: b117, b122, b130, b760, d160, d220, d825, d850, e125, e130 Third level: b1300, b1301, b1304, b7600, b7601, b7602, d2200, d2201, d2202, d2204, d8250, d8251, e1250, e1300
Arikawa et al., 2013	Case study	Individual diagnosed with AS; N=2, ($n=1,30$ -year-old male)	On-the-job occupational therapy task analysis assessment (unspecified)	<u>Executive functioning skills</u> Problem-solving, planning, predicting, attention and concentration skills improved following on-the-job training and workplace modifications delivered by an occupational therapist	W/I/VT	P	Limited (9/20), IV	Second level: b117, b760, d155, d160, d175, d250 d845, e360, e590 Third level: b7600, d1550, d1601, d1750, d1751, d2500, d2504, d8451, e5900

Table 4. Continued.

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Baker-Ericzen et al., 2017	Pilot study Pretest-posttest	Individuals with ASD; N=8 (78% male), Age: <i>M</i> =22.44 (3.55) years	Delis-Kaplan Executive Functioning System (D-KEFS), Behavior Rating Inventory of Executive Function – Adult (BRIEF-A), SRS-2, Social Skills Performance Assessment (SSPA), Functional Daily Living Questionnaire, Employment Interview, Participant Satisfaction Questionnaire	<u>Executive functioning skills</u> Increased participant reported BRIEF-A global composite scores ($p=0.018$), task monitoring, self-monitoring and planning/organizing ($p<0.05$). Improved D-KEF performance in sorting, deductive reasoning and planning ($p<0.05$). <u>Vocational skills</u> Participant reported improvement in social awareness and social motivation ($p<0.05$) scores on SRS-2. Increase in SSPA scores for ‘chat with co-worker’ and ‘request time off’ items ($p <0.05$) No significant change in daily living not related to work. Significant improvement in scheduling appointments item ($p=0.02$). <u>Employment status</u> 34% increase in paid employment at posttest ($p=0.18$). Salaries at posttest ranged from US\$10 – US\$18.	W/I/VT	P, S	Strong (19/20) II	Second level: b122, b140, b152, b164, d175, d220, d250, d310, d315, d330, d350, d570, d710, d720, d750, d845, e325, e330, e360 Third level: b1400, b1520, b1521, b1643, d1750, d1751, d2200, d2201, d2203, d3150, d3500, d3501, d3502, d3503, d3504, d5708, d7104, d7200, d7202, d7203, d7208, d7509, d8451 Fourth level: d71040, d71041
Bennet et al., 2010	Multiple baseline across participants	Individual diagnosed with ASD; N=3 ($n=1$, 22-year-old male)	Job Observation and Behaviour Scale (JOBS); normative data for accuracy and rate of task performance and feedback	<u>Vocational skills</u> Substantial improvements in work performance, maintained for 4-5 weeks following removal of the intervention	SE	M	Adequate (11/22), II	Second level: b117, b122, b156, d155, d220, d845, e130, e360, e590 Third level: b1560, d1550, d1551, d2200, d2201, d2202, d8451, e1300, e1301, e5900
Bonete et al., 2015	Pretest-posttest	Individuals diagnosed with AS; N=50 (43 males, 7 females); Age: <i>M</i> =19.54 (3.46)	Evaluación de Solución de Conflictos Interpersonales (ESCI); Osnabrück Ability to Work Profile (O-AFP); Vineland Adaptive Behaviour Scales– Second Edition (VABS-II)	<u>Vocational skills</u> Significantly higher social problem-solving ($p<0.001$) and socialisation skills ($p<0.001$) post-treatment. Differences in comparison to the control group decreased post-treatment. Treatment was acceptable to families and participant adherence was high	W/I/VT	P	Strong (20/22), II	Second level: b117, b122, d155, d175, d310, d315, d330, d350, d710, d720, e325, e360 Third level: d1551, d1750, d1751, d3100, d3101, 3102, d3150, d3500, d3501, d3502, d3503, d3504, d7100, d7101, d7102, d7103, d7104, d7106, Fourth level: d71040, d71041

Table 4. Continued.

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Burke, 2010	Multiple baseline across participants	Individuals diagnosed with AS, ASD or PDD-NOS; N=6 (18-27 years, all male)	Observation of target behaviours, recorded response of script prompt	<u>Vocational skills</u> Five out of six participants achieved criterion behaviour skills following the introduction of the cue system in addition to behavioural skills training <u>Executive functioning skills</u> The sixth reached criterion with behavioural skills training alone	W/I/VT	P	Adequate (11/22), II	Second level: b117, b122, b130, b760, d155, d160, d220, d250, d825, e125, e130 Third level: b1300, b1301, b1304, b7600, b7601, b7602, d1550, d1551, d2200, d2201, d2202, d2204, d2501, d2502, d2504, d8250, d8251, e1250, e1300
Burke et al., 2013	Multiple baseline across participants	Individuals diagnosed with AS, ASD or PDD-NOS; N=4 (19-28 years, all male)	Descriptions of task analysis (73-steps required to complete tasks); recorded task steps correctly completed; home time logs of video viewed; Universal Design Performance Measure for Productivity (UDPMP)	<u>Vocational skills</u> VM and prompting were effective with marked improvement in on-the-job performance of multi-step shipping tasks	W/I/VT	P	Adequate (11/22), II	Second level: b117, b122, b140, d155, d160, d175, d220, d825, e125, e130 Third level: b1400, b1401, b1402, d1550, d1551, d1750, d1751, d2200, d2201, d2202, d8250, d8251, e1250, e1300
Burt et al., 1991	Case study	Individuals diagnosed with ASD and ID; N=4 (21-29 years; 3 males, 1 female)	Autism Behaviour Checklist; description of employment outcomes	<u>Employment status</u> Competitive employment gained and retained between 6-30 months following an intensive training program	C	P	Limited (5/20), IV	Second level: b117, b122, d155, d175, d250, d310, d315, d330, d350, d710, d720, d845, e360, e330 Third level: d1550, d1551, d2500, d2501, d2502, d2503, d2504, d3100, d3101, d3102, d3150, d3500, d3501, d3502, d3503, d3504, d7100, d7101, d7102, d7103, d7104, d7106, d7200, d7202, d7203, d7204, d8450, d8451 Fourth level: d71040, d71041
Dotson et al., 2013	Multiple baseline across participants	Individuals diagnosed with AS, ASD or PDD-NOS; N=8 (n=5, 19-30 years; 2 males, 3 females)	The Scales of Independent Behaviour-Revised (SIB-R); description of the percentage of job steps performed correctly and without prompts	<u>Vocational skills</u> Improved job skills performance following teaching and working shifts in a natural work environment independently or alongside a peer. Teaching procedures resulted in job skill acquisition for worker, supervisor, and office staff	W/I/VT	P, M	Adequate (12/20), II	Second level: b117, b122, d155, d175, d220, d250, d310, d315, d330, d350, d825, d845, e325, e360 Third level: d1550, d1551, d1750, d2203, d2501, d2503, d2504, d3100, d3101, d3102, d3150, d3503, d8451

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Gentry et al., 2012	Case study	Individuals diagnosed with ASD; N=3 (20-60 years; 1 male, 2 females)	Self-report; description of the hours of supervision and workplace training and support	Executive functioning skills Improved task management, organisational skills and self-regulated behaviours using the PDA	C	M	Limited (9/20), IV	Second level: b140, b164, d230, d250, d845, e125, e130, e360, e590 Third level: b1400, b1641, b1642, d2300, d2301, d2305, d2306, d2501, d2503, d2504, d8451, e1251, e1301, e5900
Gentry et al., 2015	Delayed randomised controlled trial (RCT)	Individuals diagnosed with ASD; N=50 (42 males, 8 females); Age: M=24.0 (8.3)	Craig Handicap Assessment and Rating Technique (CHART); Supports Intensity Scale-Employment Subscale (SIS-EPS); Employee Performance Evaluation Report (EPER); description of the hours worked and job coach hours	Vocational skills Experimental group receiving PDA training to assist in task organisation required significantly less hours of job coaching support (p = 0.013) than the control group	C	M	Strong (20/24), II	Second level: b140, b164, d230, d250, d310, d330, d350, d845, e125, e130, e360, e590 Third level: b1400, b1641, b1642, d2300, d2301, d2305, d2306, d2501, d2503, d2504, d8451, d3100, d3101, d3103, d3503, d8451, e1251, e1301, e5900
Gilson and Carter, 2016	Multiple-probe, single-case experimental	Individuals diagnosed with ASD; N=3 (n=2, 18-26 years, both male)	Description of partial interval recording system on social and task-related interactions, job coach hours, methods and type of coaching delivered	Vocational skills Increased social interactions and task engagement when job coaches reduced proximity and delivered prompts using bug-in-ear devices. Effects maintained post-intervention	W/I/VT	P	Adequate (13/20), II	Second level: b122, b156, b164, d220, d350, d710, d840, e125, e130, e360 Third level: b1560, b1641, d2200, d2201, d3504, d7103, d7104, e1251, e1301 Fourth level: d71040, d71041
Ham, 2014	Case study	Individuals diagnosed with ASD; N=2 (1 female age not reported, 1 23-year-old male)	Indirect and direct behaviour observation, anecdotal reports, description of the level of job coach support	Employment status Intensive job coaching assisted in job retention with fading supports for two or more years Executive functioning skills Improved self-regulated behaviour and task organisation skills	SE	S, M	Adequate (10/20), IV	Second level: b164, d250, d845, e325, e330, e360 Third level: b1641, b1642, d2501, d2502, d2503, d2504, d8451

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Hayes et al., 2015	RCT	Individuals diagnosed with ASD; N=15 (17-18 years; 13 males, 2 females)	VidCoach usage log, self-report on experience, interview performance rating scale (developed for the study)	<p><u>Vocational skills</u> Experimental group demonstrated significant improvement in interview performance (p<0.001) and in hygiene and health care (p=0.02)</p> <p><u>Executive functioning skills</u> Experimental group displayed significantly reduced fidgeting (p=0.022), improved skills in presenting ideas logically and succinctly (p=0.009). Control group displayed significant improvement in grammar and vocabulary usage (p<0.001)</p>	W/I/VT	P	Limited (11/26), II	<p>Second level: b117, b122, b140, d155, d220, d310, d315, d330, d350, d710, d825, d845, e125, e130</p> <p>Third level: b1400, b1401, 1558, d2209, d3100, d3101, d3102, d3150, d3508, d7108, e1251, e1301</p>
Hill et al., 2013	Case study	Individuals diagnosed with ASD; N=3 (23-26 years; 1 male, 2 females)	Self-report	<p><u>Employment status</u> Use of iPad device and support strategies culminated in increased independence, job placement and job retention.</p>	SE	S, M	Limited (9/20), IV	<p>Second level: b122, b140, b164, d250, d710, d845, e125, e130, e360</p> <p>Third level: b1400, b1401, b1641, b1642, d2501, d2503, d2504, d7108, d8451, e1251, e1301</p>
Hillier, 2007	Observational cohort study without a control group	Individuals diagnosed with ASD; N=9 (18-36 years; 8 males, 1 female)	Assessment Worksheet, Socialisation Scale, Job Satisfaction Index, Program Satisfaction Measures (all designed for the study), case notes	<p><u>Employment status</u> 78% increase in employment rates; wage ranged between US \$5.15-\$8.99 per hour, hours worked ranged between 4-40 per week. Average job retention of 12.5 months</p>	C	P, S, M	Good (14/20), II	<p>Second level: b117, d220, d250, d310, d330, d350, d710, d720, d845, e360</p> <p>Third level: d2204, d2503, d2504, d3100, d3101, d3102, d3508, d7203 d8450, d8451</p>
Kellems and Morningstar, 2012	Multiple-probe baseline across participants	Individuals diagnosed with AS or ASD; N=4 (20-22 years; all male)	Percentage of independent task steps completed correctly	<p><u>Vocational skills</u> Functional relation found between VM using iPods and increase in the percentage of work tasks steps correctly completed. All participants maintained performance on first two vocational skills for up to 30 days</p>	SE	M	Adequate (11/20), II	<p>Second level: b122, b140, b164, d155, d160, d220, d845, e130</p> <p>Third level: b1400, b1641, d1558, d1608, d2200, d8451, e1308</p>

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Lattimore, 2006	Multiple-probe baseline across participants	Individuals diagnosed with ASD and ID; N=3 (30-42 years; all male)	Percentage of independent task steps completed correctly for job-site training and simulation training	<u>Vocational skills</u> Acquisition of work-related skills increased with both job-site and simulation training compared to job-site training only, 88% of tasks completed independently; effects maintained post intervention	SE	M	Adequate (11/22), II	Second level: b117, b122, d155, d220, d845, d859, e360, e585, e590 Third level: d1558, d2200, d8450, e5850, e5900
Lattimore, 2008	Multiple-probe baseline across participants	Individuals diagnosed with ASD and ID; N=4 (29-32 years; all male)	Percentage of job task steps completed independently	<u>Vocational skills</u> Acquisition of work-related skills in simulation training improved independent job performance; skills maintained 1-31 weeks post intervention	SE	M	Adequate (12/22), II	Second level: b117, b122, d155, d220, d845, d859, e360, e585, e590 Third level: d1558, d2200, d8450, e5850, e5900
Liu et al., 2013	Pretest-posttest	Individuals diagnosed with ASD and ID; N=14 (10 males, 4 females); Age: M=24.6 (10.04)	Work Personality Profile (WPP), SIB-R, Observational Emotional Inventory Revised (OEI-R)	<u>Vocational skills</u> Improved workplace social behaviours in WPP (p=0.08); significant differences in workplace social communication in SIB-R (p=0.02) <u>Executive functioning skills</u> Significant difference in emotional response to socialisation in the workplace, better concept of self (p=0.04); limited generalised emotional behavioural control	C	P, M	Strong (17/20), II	Second level: b117, b122, b152, d155, d220, d310, d315, d330, d335, d349, d350, d710, d720, e398, e590 Third level: b1521, d2200, d3102, d3150, d3500, d3504, d3350, d7104, d7108, d7202, e5900 Fourth level: d71041
Lynas, 2014	Longitudinal observation cohort study without a control group	Individuals diagnosed with HFASD; N=67 (63 males, 4 females, age not reported)	Description of employment outcomes in relation to: employed in full-time, part-time, work experience, and feedback questionnaire	<u>Employment status</u> 56% of adults using program were employed in FT/PT positions; 66% had at 2-3 work experience opportunities <u>Vocational skills</u> Increased more than 40% in social, communication and independence skills	SE	S, M	Good (14/20), V	Second level: b117, b122, d155, d470, d720, d840, d845, d860, e360, e590 Third level: d1558, d4709, d7203, d8450, d8451, e5900

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Mawhood and Howlin, 1999	Case-controlled study	Case: individuals diagnosed with HFA; n=30 (27 males, 3 females); Age: <i>M</i> =31.1 (9.1) Control: individuals matched in intellectual and linguistic; n=20 (all male); Age: <i>M</i> =28 (6.1)	Rosenberg Self-Esteem Inventory, follow-up questionnaires in relation to support satisfaction, wages, hours worked, and relationships formed, Work Personality Profile, and feedback from employers	Employment status Experimental group had significantly higher rates of FT/casual employment (<i>p</i> =0.01), higher wages (<i>p</i> =0.02) and required less supported over time (<i>p</i> =0.001); no significant difference in hours worked (hours between 31.3-36.5); wages ranged from £3.71-£9.49	SE	S, M	Adequate (17/26), II	Second level: b117, b122, d720, d840, d845, e325, e330, e360, e590 Third level: d7203, d8450, d8451, e5900
McLaren et al., 2017	Pilot study Pretest-posttest	Individuals with ASD; N=5 (4 males, 1 females); Age: 19-28 years.	Demographic information, employment status, hourly wages, qualitative interviews	Employment status All participants obtained competitive employment in field of choosing. Wages ranged from US\$8.00-\$15.00 per hour. In addition, qualitative improvement was reported for daily living	SE	S	Limited (7/22), II	Second level: b117, b122, b40, b152, d570, d750, d760, d845, e360, e590 Third level: b1400, d5708, d7508, d7600, d8450, d8451, e5900
Morgan et al., 2014	Pilot RCT	Individuals diagnosed with ASD; N=28 (27 males, 1 female) Intervention: <i>n</i> =13; Age: <i>M</i> =25.08 (5.85) Control: <i>n</i> =15; Age: <i>M</i> = 24 (4.8)	Mock interviews, Social Pragmatic Scale (developed for study); VABS-II; Patient Health Questionnaire-9 (PHQ-9)	Vocational skills Experimental groups had increased gain in social-pragmatic skills in mock interview, no significant difference in social adaptive behaviours between groups Executive functioning skills No significant differences in depressive symptoms	C	P	Good (18/24), I	Second level: b117, b122, d310, d315, d330, d335, d350, d599, d845, e325, e360 Third level: d3500, d3501, d3502, d3503, d3504, d3102, d3150, d3350, d8450
Rausa et al., 2016	Multiple baseline across behaviours	Individual diagnosed with ASD; N=1, 23-year-old male	Imitation Disorders Evaluation; percentage of the response criteria completed correctly	Vocational skills VM improved listening, responding to orders and complaints and using professional speech with customers; skills maintained at 6-week follow up	C	P	Strong (22/22), II	Second level: b117, b122, b140, d155, d210, d310, d330, d350, d360, d845, e130 Third level: b1400, d1558, d3600, d2105, d3102, d3503, d8451, e1308

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Rosen et al., 2017	Usability evaluation Case-control study	Individuals with ASD; N=20 (18 males, 2 females), Age: <i>M</i> =18.7 (1.2) years. Typically developing controls; N=20 (18 males, 2 females), Age: <i>M</i> =16.4 (0.5) years.	Demographics, identification of adaptive/maladaptive social responses, Intrinsic Motivation Inventory (IMI), Relevance Questionnaire, Facilitator Observation Form.	<u>Vocational Skills</u> Individuals with ASD had greater difficulty than controls in selecting adaptive strategies to respond to work-related social dilemma scenarios ($p=0.02$). ASD group rated higher enjoyment ($p=0.02$) and less perceived choice ($p=0.01$) than control group. Individuals with ASD rated the application as more personally relevant than controls ($p<0.05$).	N/A	P	Strong (20/22) II	Second level: b117, b122, b140, d175, d310, d330, d350, d710, d740, d825, e125, e130, e360 Third level: b1400, d3500, d3501, d3502, d3503, d7100, d7103, d7108, d7400, e1250, e1300
Schall, 2010	Case study	Individual diagnosed with ASD; N=1, 25-year-old male	Functional behaviour assessment, observation of behaviour frequency	<u>Executive functioning skills</u> Positive behaviour support reduced problem behaviour through replacement strategies and positive reinforcement	C	M	Limited (4/20), V	Second level: b122, b164, d335, d349, d845, e325, e330, e360 Third level: b1641, d3551, d8450, d8451
Smith and Coleman, 1986	Case study	Individuals diagnosed with ASD and ID; N=3 (25-27 years, all male)	Behaviour observation, description of the number of tantrums, performance rate per hour	<u>Executive functioning skills</u> Behaviour management either reduced frequency of eliminated aggressive and oppositional behaviour and increased productivity	C	M	Limited (8/18), IV	Second level: b117, b122, d330, d349, d710, d845, e360 Third level: d7108, d8451
Smith et al., 2014	RCT	Individuals diagnosed with ASD; Intervention: $n=16$ (12 males, 4 females); Age: <i>M</i> =24.9 (6.7) Control: $n=10$ (8 males, 2 females); Age: <i>M</i> =23.2 (3.0)	Social Responsiveness Scale-2 (SRS-2); Repeatable battery for the assessment of neuropsychological status (RBANS); Bell-Lysaker Emotion Recognition Task (BLERT); Emotional perspective-taking task (advanced social cognition) based on the number of correct responses	<u>Vocational skills</u> Experimental group had significantly greater skills in interview role-play performance ($p=0.04$) and self-confidence ($p=0.06$) than controls	C	P, S	Strong (19/20), I	Second level: b117, b122, b140, d155, d220, d310, d330, d350, d360, d720, d845, e125, e130, e360 Third level: b1400, b1402, d1558, d2200, d3102, d3108, d3503, d3608, d7200, d8450, e1251, e1301,

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Strickland et al., 2013	RCT	Individuals diagnosed with AS or HFA; N=22, all male Intervention: n=11; Age: M=18.21 (1.03) Control: n=11; Age: M=17.66 (1.27)	Interview Skills Rating Instrument (developed for study); SRS	<u>Vocational skills</u> Experimental group had significantly more effective verbal skills for job interviews than the control group (p<0.000)	C	P, S	Strong (22/22), I	Second level: b117, b122, b140, d155, d220, d250, d310, d315, d330, d335, d350, d360 d720, d845, e125, e130, e360 Third level: b1400, d1558, d2200, d2501, d2502, d2503, d3100, d3102, d3150, d3350, d3503, d3608, d7203, d8450, e1251, e1301
Walsh et al., 2018	Pilot study Multiple probe design	Individuals with ASD with co-occurring ID; N=7, Age (19.2 – 22.3 years, 4 males, 3 females)	Observation during performance probes, SRS-2, Social skills Improvement Rating Scales (SSiS), ACCESS placement test	<u>Vocational skills</u> Significant increase in target social skills (8-14% of skills observed at baseline, 73-100% observed at posttest), significant increase in Social skills improvement rating scales score (p<0.05). Increase in ACCESS placement scores (p<0.05). Decrease in problem behaviors.	W/I/VT	P	Strong (19/20), II	Second level: b117, b1220, b140, d210, d230, d240, d330, d350, d570, d710, d720, d750, d835, e125, e130, e360 Third level: b1400, d2108, d2308, d2400, d2401, d3500, d3501, d3503, d3504, d5708, d7102, d7103, d7202, d7500, e1250, e1300
Wehman et al., 2012	Prospective cohort study	Individuals diagnosed with ASD; N=33 (19-59 years, M=25; 25 males, 8 females)	Description of employment outcomes in relation to: job title, wages, hours worked per week, benefits, average employment intervention specialist time	<u>Employment status</u> 82% successfully gain competitive employment with the assistance of an employment specialist, earning the same or similar wages as co-workers, working M=22.53 hours/week, wages ranged from US\$7.25- \$10.50	C	S, M	Strong (15/18), III	Second level: b117, b122, d132, d720 d845, e135, e360, e590 Third level: d7203, d8450, d8451, e1358, e5900
Wehman et al., 2013	Case study	Individuals diagnosed with AS or ASD; N=2 (19-20 years, both male)	Self-rated evaluation measure on work performance across the dimensions: performance of job skills, production rate, accuracy, communication, interaction with co-workers, appearance and safety	<u>Employment status</u> Both employed in different job positions for 20 hours/week; average wages US \$9.14 <u>Vocational skills</u> Employment program role -playing managed and improved social interactions and workplace social behaviour <u>Executive functioning skills</u> Improved self-management and organisational skills	C	S, M	Strong (19/22), V	Second level: b122, b164, d155, d250, d310, d315, d330, d349, d350, d710, d720, d840, d845, e135, e330, e360 Third level: b1641, b1642, d1558, d2502, d3100, d3102, d3150, d3508, d7203, d8450, d8451, e1358

Table 4. Continued

Reference	Design	Participants	Outcome measures	Intervention results	Type of employment	Employment stage	Quality and level of evidence	ICF category codes ^{a,b}
Wehman, 2014	Preliminary RCT	Individuals diagnosed with AS, ASD or PDD-NOS; N=40 Intervention: n=24 (18 males, 6 females); Age: M=19.96 (1.09) Control: n=16 (11 males, 5 females); Age: M=19.13 (1.09)	SIS, interviews to collect demographic and employment status information	Employment status Significant difference in employment attainment for experimental group (p=0.000), maintained at 3-month follow-up, increase in hours worked over 3-months; wages ranged from US\$9.00-\$9.63 per hour, no significant difference for employment support required	C	S, M	Strong (17/18), I	Second level: b122, b164, d155, d220, d250, d310, d315, d330, d349, d350, d710, d720, d840, d845, e135, e330, e360 Third level: b1641, b1642, d1558, d2208, d2502, d3100, d3102, d3150, d3508, d7203, d8450, d8451, e1358
Wehman et al., 2016b	RCT	Individuals diagnosed with AS, ASD or PDD-NOS; N=49 Intervention: n=31 (24 males, 7 females); Age: M=20.23 (1.13) Control: n=18 (11 males, 7 females); Age: M=19.33 (1.42)	SIS, interviews to collect demographic and employment status information	Employment status Intervention group more likely to be employed than control (p<0.001). Intervention group employment rates were: 74.2% at graduation and 90.3% at 3-month follow up. One-year post-graduation 87.1% maintained employment. Significant increase in wages in intervention group compared to control (p<0.001). Intervention group wages ranged from US\$9.53 to US\$10.66 per hour. Control group wages ranged from US\$9.67 to US\$10.00 per hour. At 12-month-follow up intervention group worked more hours than control group (p=0.027). Significant improvement in SIS scores for intervention group compared to control (p<0.001).	C	S, M	Strong (19/20), I	Second level: b122, b164, d155, d220, d250, d310, d315, d330, d349, d350, d710, d720, d840, d845, e135, e330, e360 Third level: b1641, b1642, d1558, d2502, d3100, d3102, d3150, d3508, d7203, d8450, d8451, e1358

Note. W/I/VT: Work experience or internship or vocational training; S: Sheltered employment; SE: Supported employment; C: Competitive employment

P: Preparing for employment; S: Seeking or securing employment; M: Maintaining employment

ASD: Autism spectrum disorder; AS: Asperger's syndrome; HFASD: High functioning ASD; PDD-NOS: Pervasive developmental disorder not-otherwise specified, according to the DSM-IV (American Psychiatric Association, 2000); ID: Intellectual disability

M: Mean; RCT: Randomised controlled trial; VM: video modelling; FT/PT: Full-time/ Part-time; PDA: Personal digital assistant

JOBS: Job Observation Behaviour Scale; ESCI: Evaluación de Solución de Conflictos Interpersonales; O-AFP: Osnabrück Ability to Work Profile; VABS-II: Vineland Adaptive Behaviour Scales-Second Edition; UDPMP: Universal Design Performance Measure for Productivity; SIB-R: Scales of Independent Behaviour-Revised; CHART: Craig Handicap Assessment and Rating Technique; SIS-EPS: Supports Intensity Scale-Employment Subscale; EPER: Employee Performance Evaluation Report; WPP: Work Personality Profile; Observational Emotional Inventory Revised; PHQ-9: Patient Health Questionnaire-9; SRS-2: Social Responsiveness Scale-Second edition; RBANS: Repeatable battery for the assessment of neuropsychological status; BLERT: Bell-Lysaker Emotion Recognition Task

^a ICF categories within the table can be found in ICF-CY version as developed by the World Health Organization (World Health Organization, 2007)

^b ICF category codes defined according to the ICF Core Sets for ASD (Bölte et al., 2017) and linked according to the ICF linking rules (Cieza et al., 2005)

Table 5. Absolute and relative frequencies of ICF categories from the Activity and Participation component of employment programs and intervention studies (*k*=36)

Second level category code	Category code description	N (%)
d845	Acquiring, keeping and terminating a job	27 (75%)
d155	Acquiring skills	18 (50%)
d220	Undertaking multiple tasks	18 (50%)
d330	Speaking	18 (50%)
d350	Conversation	18 (50%)
d310	Communicating with-receiving-spoken messages	16 (44%)
d250	Managing one's own behaviour	14 (38%)
d720	Complex interpersonal interactions	14 (38%)
d710	Basic interpersonal interactions	14 (38%)
d315	Communicating with-receiving-nonverbal messages	11 (31%)
d175	Solving problems	7 (19%)
d825	Vocational training	7 (19%)
d160	Focusing attention	6 (17%)
d349	Communication-producing, other specified and unspecified	6 (17%)
d840	Apprenticeship (work preparation)	6 (17%)
d335	Producing nonverbal messages	4 (11%)
d230	Carrying out daily routine	3 (8%)
d360	Using communication devices and techniques	3 (8%)
d570	Looking after one's health	3 (8%)
d750	Informal social relationships	3 (8%)
d210	Undertaking a single task	2 (6%)
d859	Work and employment, other specified and unspecified	2 (6%)

Table 6. Absolute and relative frequencies of ICF categories from the Environmental Factors component of employment program and intervention studies ($k=36$)

Second level category code	Category code description	N (%)
e360	Other professionals	28 (78%)
e130	Products and technology for education	16 (44%)
e125	Products and technology for communication	13 (36%)
e590	Labour and employment services, systems and polices	11 (31%)
e330	People in positions of authority	8 (22%)
e325	Acquaintances, peers, colleagues, neighbours and community members	7 (19%)
e135	Products and technology for employment	4 (11%)
e585	Education and training services, systems and polices	2 (6%)

Table 7. Absolute and relative frequencies of ICF categories from the Body Functions component of employment program and intervention studies ($k=36$)

Second level category code	Category code description	N (%)
b122	Global psychosocial functions	31 (86%)
b117	Intellectual functions	25 (69%)
b140	Attention functions	12 (33%)
b164	Higher-level cognitive functions	11 (31%)
b760	Control of voluntary movement functions	4 (11%)
b130	Energy and drive functions	3 (8%)
b156	Perceptual functions	2 (6%)

Supplementary material

SI Table. Employment program and intervention studies linked to the component of the ICF^a according to target, modality and outcome of interventions ($k=36$)

Author	Purpose of the intervention	Target of the intervention		Modality of the intervention	Outcome of the intervention
		Body functions	Activities and Participation	Environmental Factors	
Allen et al., 2010a, USA	To evaluate the use of video modelling (VM) to teach individual with ASD the necessary skills to perform in a WalkAround air-inflated mascot	Second level: b117, b122, b130, b760 Third level: b1300, b1301, b1304, b7600, b7601	Second level: d160, d220, d825 Third level: d2200, d2201, d2202, d2204, d8250, d8251,	Second level: e125, e130 Third level: e1250, e1300	Second level: b122, d825 Third level: d8251
Allen et al., 2010b, USA	To investigate the use of VM for acquisition of selected vocational skills by individuals with ASD, and evaluate the feasibility of individuals with ASD tolerating wearing WalkAround air-inflated costume for short periods of time	Second level: b117, b122, b130, b760 Third level: b1300, b1301, b1304, b7600, b7601, b7602,	Second level: d160, d220, d825, d850 Third level: d2200, d2201, d2202, d2204, d8250, d8251	Second level: e125, e130 Third level: e1250, e1300	Second level: b122, d825 Third level: d8251
Arikawa et al., 2013, Japan	To provide an overview of employment support by an occupational therapist for people with developmental disabilities and the roles they should engaged in and the necessary support they should provide	Second level: b117, b760 Third level: b7600	Second level: d155, d160, d175, d250 d845 Third level: d1550, d1601, d1750, d1751, d2500, d2504, d8451	Second level: e360, e590 Third level: e5900	Second level: d845 Third level: d8451
Baker-Ericzen et al., 2017, USA	To investigate the feasibility, acceptability and initial estimates of outcomes of the Supported Employment Comprehensive Cognitive Enhancement and Social Skills (SUCCESS) program in improving social-cognitive skills in young adults with ASD in a vocational training setting.	Second level: b122, b140, b152, b164 Third level: b1400, b1520, b1521, b1643	Second level: d175, d220, d250, d310, d315, d330, d350, d570, d710, d720, d750, d845 Third level: d1750, d1751, d2200, d2201, d2203, d3150, d3500, d3501, d3502, d3503, d3504, d5708, d7104, d7200, d7202, d7203, d7208, d7509, d8451 Fourth level: d71040, d71041	Second level: e325, e330, e360	Second level: b164, d175, d250, d315, d570, d720, d845 Third level: d3150, d5708, d7203, d8451
Bennett at al., 2010, USA	To examine the effects of covert audio coaching (CAC) on job performance of supported employees in community employment	Second level: b117, b122, b156 Third level: b1560	Second level: d155, d220, d845 Third level: d1550, d1551, d2200, d2201, d2202, d8451	Second level: e130, e360, e590 Third level: e1300, e1301, e5900	Second level: d155, d845 Third level: d1550, d1551, d8451
Bonete et al., 2015, Spain	To test the effectiveness of the Interpersonal Problem-solving for Workplace Adaption Programme for adults with ASD, and evaluate its feasibility	Second level: b117, b122,	Second level: d155, d175, d310, d315, d330, d350, d710, d720 Third level: d1551, d1750, d1751, d3100, d3101, 3102, d3150, d3500, d3501. d3502, d3503, d3504, d7100, d7101, d7102, d7103, d7104, d7106 Fourth level: d71040, d71041	Second level: e325, e360	Second level: b122, d155 Third level: d1550, d1551

SI Table. Continued

Author	Purpose of the intervention	Target of the intervention		Modality of the intervention	Outcome of the intervention
		Body functions	Activities and Participation	Environmental Factors	
Burke, 2010, USA	To evaluate the efficacy of behavioural skills training and a novel personal digital assistant (PDA)-based performance cue system on individuals' with ASD abilities to perform complex workplace behaviours	Second level: b117, b122, b130, b760 Third level: b1300, b1301, b1304, b7600, b7601, b7602	Second level: d155, d160, d220, d250, d825 Third level: d1550, d1551, d2200, d2201, d2202, d2204, d2501, d2502, d2504, d8250, d8251	Second level: e125, e130 Third level: e1250, e1300	Second level: b122, d155, d825 Third level: d1550, d1551, d8251
Burke et al., 2013, USA	To test computer software that enhances job training and job performance through VM, video prompting and feedback via a computer tablet	Second level: b117, b122, b140 Third level: b1400, b1401, b1402	Second level: d155, d160, d175, d220, d825 Third level: d1550, d1551, d1750, d1751, d2200, d2201, d2202, d8250, d8251	Second level: e125, e130 Third level: e1250, e1300	Second level: d155, d825 Third level: d1550, d1551, d8251
Burt et al., 1991, USA	The effects of a training program for adults with ASD, using a behavioural skills approach to enable employment	Second level: b117, b122,	Second level: d155, d175, d250, d310, d315, d330, d350, d710, d720, d845, Third level: d1550, d1551, d2500, d2501, d2502, d2503, d2504, d3100, d3101, d3102, d3150, d3500, d3501, d3502, d3503, d3504, d7100, d7101, d7102, d7103, d7104, d7106, d7200, d7202, d7203, d7204, d8450, d8451 Fourth level: d71040, d71041	Second level: e330, e360	Second level: d155, d845 Third level: d1550, d1551, d8450, d8451
Dotson et al., 2013, USA	To determine the effectiveness of a group teaching procedure in increasing skill levels of individuals learning a subset of self-employment skills, and to evaluate the effects of extending teaching to the natural environment on performance	Second level: b117, b122	Second level: d155, d175, d220, d250, d310, d315, d330, d350, d825, d845, Third level: d1550, d1551, d1750, d2203, d2501, d2503, d2504, d3100, d3101, d3102, d3150, d3503, d8451	Second level: e325, e360	Second level: b122, d155, d845 Third level: d1550, d1551, d8451
Gentry et al., 2012, USA	Case studies examining individuals with ASD who have been trained to use the Apple iPod Touch PDAs as vocational supports in their workplaces and impact on their functional performance and behaviour	Second level: b140, b164 Third level: b1400, b1641, b1642	Second level: d230, d250, d845 Third level: d2300, d2301, d2305, d2306, d2501, d2503, d2504, d8451	Second level: e125, e130, e360, e590 Third level: e1251, e1301, e5900	Second level: d845 Third level: d2501, d2503, d2504, d8451
Gentry et al., 2015, USA	To determine if the use of an Apple iPod Touch would reduce the need for personal supports in performing job tasks and building on-the-job confidence	Second level: b140, b164, Third level: b1400, b1641, b1642	Second level: d230, d250, d310, d330, d350, d845 Third level: d2300, d2301, d2305, d2306, d2501, d2503, d2504, d8451, d3100, d3101, d3103, d3503, d8451	Second level: e125, e130, e360, e590 Third level: e1251, e1301, e5900	Second level: d845 Third level: d2501, d2503, d2504, d8451

SI Table. Continued

Author	Purpose of the intervention	Target of the intervention		Modality of the intervention	Outcome of the intervention
		Body functions	Activities and Participation	Environmental Factors	
Gilson and Carter, 2016, USA	A pilot study examining the effect of a CAC job coaching package including audio cuing, social-focused coaching and reducing the proximity of job coaches	Second level: b122, b156, b164 Third level: b1560, b1641	Second level: d220, d350, d710, d840 Third level: d2200, d2201, d3504, d7103, d7104 Fourth level: d71040, d71041	Second level: e125, e130, e360 Third level: e1251, e1301	Second level: d840 Third level: d7103, d7104 Fourth level: d71040, 71041
Ham, 2014, USA	To describe successful employment for two individuals with ASD taking part in Project SEARCH	Second level: b164 Third level: b1641, b1642	Second level: d250, d845 Third level: d2501, d2502, d2503, d2504, d8451	Second level: e325, e330, e360	Second level: d845 Third level: d8451
Hayes et al., 2015, USA	To evaluate the efficacy of mobile device delivering peer and self-modelling/promoting support for job interviews across industries	Second level: b117, b122, b140 Third level: b1400, b1401	Second level: d155, d220, d310, d315, d330, d350, d710, d825, d845 Third level: d1558, d2209, d3100, d3101, d3102, d3150, d3508, d7108, Third level: d250, d710, d845 Third level: d2501, d2503, d2504, d7108, d8451	Second level: e125, e130 Third level: e1251, e1301	Second level: d155 Third level: d1558
Hill et al., 2013, USA	To investigate the use of the iPad as an employment support tool in increasing independence and success for individuals with ASD in a program that provided employment support	Second level: b122, b140, b164 Third level: b1400, b1401, b1641, b1642	Second level: d250, d710, d845 Third level: d2501, d2503, d2504, d7108, d8451	Second level: e125, e130, e360 Third level: e1251, e1301	Second level: d845 Third level: d8451
Hillier, 2007, USA	To evaluate the effect of a 2-year vocational support program on employment rates and participant income, and explore the factors impacting job satisfaction, social integration and employers' evaluations of job performance for individuals with ASD	Second level: b117	Second level: d220, d250, d310, d330, d350, d710, d720, d845 Third level: d2204, d2503, d2504, d3100, d3101, d3102, d3508, d7203 d8450, d8451	Second level: e360	Second level: d845 Third level: d8451
Kellems and Morningstar, 2012, USA	To evaluate the effectiveness of using VM delivered through an Apple iPod for teaching job-related tasks to individuals with ASD	Second level: b122, b140, b164 Third level: b1400, b1641	Second level: d155, d160, d220, d845 Third level: d1558, d1608, d2200, d8451	Second level: e130 Third level: e1308	Second level: b122, d155, d845 Third level: d1508, 8451
Lattimore, 2006, USA	To compare the effects of job-site training supplemented with simulation training to job-site training alone in the acquisition of job skills for individuals with ASD	Second level: b117, b122	Second level: d155, d220, d845, d859 Third level: d1558, d2200, d8450	Second level: e360, e585, e590 Third level: e5850, e5900	Second level: b122, d155, d845 Third level: d1508, d8450
Lattimore, 2008, USA	To explore simulation training of supported work skills before adults with ASD received on-the-job skills training and evaluate simulation training materials that are different to the actual job site	Second level: b117, b122,	Second level: d155, d220, d845, d859 Third level: d1558, d2200, d8450	Second level: e360, e585, e590 Third level: e5850, e5900	Second level: b122, d155, d845 Third level: d1508, d8450

SI Table. Continued

Author	Purpose of the intervention	Target of the intervention		Modality of the intervention	Outcome of the intervention
		Body functions	Activities and Participation	Environmental Factors	
Liu et al., 2013, Hong Kong	To explore the effectiveness of a workplace training programme targeted at enhancing work-related behaviours in individuals with ASD and intellectual disabilities	Second level: b117, b122, b152, Third level: b1521	Second level: d155, d220, d310, d315, d330, d335, d349, d350, d710, d720 Third level: d2200, d3102, d3150, d3500, d3504, d3350, d7104, d7108, d7202 Fourth level: d71041	Second level: e398, e590 Third level: e5900	Second level: d155, d349 Third level: d7108
Lynas, 2014, UK	To prepare individuals with ASD for employment using a customised employment approach to develop and improve their employability skills	Second level: b117, b122	Second level: d155, d470, d720, d840, d845, d860 Third level: d1558, d4709, d7203, d8450, d8451	Second level: e360, e590 Third level: e5900	Second level: b122, d840, d845 Third level: d1558, d8450, d8451
McLaren et al., 2017, Lebanon	To evaluate the use of an Individual Placement Support (IPS) model in assisting young adults with ASD to obtain and maintain competitive employment.	Second level: b117, b122, b140, b152 Third level: b1400	Second level: d570, d750, d760, d845 Third level: d5708, d7508, d7600, d8450, d8451	Second level: e360, e590 Third level: e5900	Second level: b152, d570, d750, d760, d845 Third level: d5708, d7508, d7600, d8451
Mawhood and Howlin, 1999, UK	To explore the outcomes of 2-year supported employment project for individuals with high functioning ASD	Second level: b117, b122	Second level: d720, d840, d845 Third level: d7203, d8450, d8451	Second level: e325, e330, e360, e590 Third level: e5900	Second level: d845 Third level: d8450, d8451
Morgan et al., 2014, USA	To evaluate the efficacy of an interview skills curriculum delivered in a group format for individuals with ASD in improving their social-pragmatic skills required for a job interview	Second level: b117, b122	Second level: d310, d315, d330, d335, d350, d599, d845 Third level: d3500, d3501, d3502, d3503, d3504, d3102, d3150, d3350, d8450	Second level: e325, e360	Second level: d845 Third level: d8451
Rausa et al., 2016, AUS	To examine the effectiveness of VM in teaching job-related telephone skills to individuals with ASD	Second level: b117, b122, b140 Third level: b1400	Second level: d155, d210, d310, d330, d350, d360, d845 Third level: d1558, d3600, d2105, d3102, d3503, d8451	Second level: e130 Third level: e1308	Second level: b122, d155, d845 Third level: 1558, d8451
Rosen et al., 2017, Israel	To evaluate the usability of <i>Ready, Set, Work!</i> , a job readiness video modelling application for adolescents with and without ASD	Second level: b117, b122, b140 Third level: b1400	Second level: d175, d310, d330, d350, d710, d740, d825 Third level: d3500, d3501, d3502, d3503, d7100, d7103, d7108, d7400	Second level: e125, e130, e360 Third level: e1250, e1300	Second level: d710, d825 Third level: d7100, d7103, d7108
Schall, 2010, USA	To describe the positive behaviour support model implement in community workplace to adapt socially appropriate behaviour for individuals with ASD	Second level: b122, b164, Third level: b1641	Second level: d335, d349, d845 Third level: d3551, d8450, d8451	Second level: e325, e330, e360	Second level: d845 Third level: d8451
Smith and Coleman, 1986, USA	To facilitate the adjustment of individuals with ASD in the workplace through behaviour management practices	Second level: b117, b122,	Second level: d330, d349, d710, d845 Third level: d7108, d8451	Second level: e360	Second level: d710, d845 Third level: d7108, d8451

SI Table. Continued

Author	Purpose of the intervention	Target of the intervention		Modality of the intervention	Outcome of the intervention
		Body functions	Activities and Participation	Environmental Factors	
Smith et al., 2014, USA	To evaluate the effectiveness of virtual reality job interview training in improving job interview skills and enhancing self-confidence in individuals with ASD	Second level: b117, b122, b140 Third level: b1400, b1402	Second level: d155, d220, d310, d330, d350, d360, d720, d845 Third level: d1558, d2200, d3102, d3108, d3503, d3608, d7200, d8450	Second level: e125, e130, e360 Third level: e1251, e1301	Second level: b122, d155, d845 Third level: d1508, d8450
Strickland et al., 2013, USA	To evaluate the effectiveness of an internet accessed training program in teaching job interview skills using theory of mind, video models, visual supports and virtual reality training for individuals with high functioning ASD	Second level: b117, b122, b140 Third level: b1400	Second level: d155, d220, d250, d310, d315, d330, d335, d350, d360 d720, d845 Third level: d1558, d2200, d2501, d2502, d2503, d3100, d3102, d3150, d3350, d3503, d3608, d7203, d8450	Second level: e125, e130, e360 Third level: e1251, e1301	Second level: b122, d155 Third level: d1508
Walsh et al., 2018, Ireland	To evaluate the effectiveness of the Adolescent Curriculum for Communication and Effective Social Skills (ACCESS) program and video modelling in increasing the social communication skills required for workplace inclusion for adults with ASD	Second level: b117, b122 b140 Third level: b1400	Second level: d210, d230, d240, d330, d350, d570, d710, d720, d750, d835 Third level: d2108, d2308, d2400, d2401, d3500, d3501, d3503, d3504, d5708, d7102, d7103, d7202, d7500	Second level: e125, e130, e360 Third level: e1250, e1300	Second level: d330, d350, d710, d720, d825 Third level: d3500, d3501, d3503, d3504, d7102, d7103, d7202
Wehman et al., 2012, USA	To examine the effects of supported employment in finding and maintaining competitive employment for individuals with ASD	Second level: b117, b122,	Second level: d132, d720 d845 Third level: d7203, d8450, d8451	Second level: e135, e360, e590 Third level: e1358, e5900	Second level: d845 Third level: d8450, d8451
Wehman et al., 2013, USA	To describe the components of Project Search and its adaptation for individuals with ASD including behavioural supports, structure, social and visual supports and role-playing	Second level: b122, b164, Third level: b1641, b1642,	Second level: d155, d250, d310, d315, d330, d349, d350, d710, d720, d840, d845 Third level: d1558, d2502, d3100, d3102, d3150, d3508, d7203, d8450, d8451	Second level: e135, e330, e360 Third level: e1358	Second level: d845 Third level: d8450, d8451
Wehman, 2014, USA	To examine the preliminary results of the effectiveness of a securing employment for individuals with ASD taking part in the Project Search employment program	Second level: b122, b164, Third level: b1641, b1642	Second level: d155, d220, d250, d310, d315, d330, d349, d350, d710, d720, d840, d845 Third level: d1558, d2208, d2502, d3100, d3102, d3150, d3508, d7203, d8450, d8451	Second level: e135, e330, e360 Third level: e1358	Second level: d220, d845 Third level: d2208, d8450, d8451
Wehman et al., 2016b, USA	To examine the effectiveness of obtaining job skills and securing employment for individuals with ASD taking part in the Project Search employment program	Second level: b122, b164, Third level: b1641, b1642	Second level: d155, d220, d250, d310, d315, d330, d349, d350, d710, d720, d840, d845 Third level: d1558, d2502, d3100, d3102, d3150, d3508, d7203, d8450, d8451	Second level: e135, e330, e360 Third level: e1358	Second level: d845 Third level: d8450, d8451

Note: ^aICF categories within the table can be found in ICF-CY version as developed by the World Health Organization (2007).
VM: Video modelling; ASD: Autism spectrum disorder; CAC: covert audio coaching; PDA: Personal Digital Assistant

