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Evaluation of career planning tools for use with individuals with autism spectrum disorder: A systematic review

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ABSTRACT

This systematic review aimed to identify tools published in peer reviewed journals that could be utilised in career planning for individuals with autism spectrum disorder (ASD), and to describe their clinical utility and psychometric properties. Due to limited results for ASD-specific tools, the search was broadened to career planning tools for individuals with a cognitive or developmental disability, which could be used by individuals with ASD. Six databases were electronically searched. Main search terms used were 'disability', 'young adult', 'assessment' and 'employment'. Boolean operators expanded the search strategy. Two independent reviewers undertook data extraction and quality assessment. Electronic searches located 2348 literature items; 14 articles met inclusion criteria covering 10 career planning tools. Identified tools were of a predictive nature; however, none of the studies assessed all the psychometric properties necessary for evaluating a sound predictive tool. Only one addressed all three components of clinical utility. None of the identified tools had strong reliability or validity and their clinical utility remains unexplored.

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1. Introduction

Many young adults with autism spectrum disorder (ASD) do not successfully transition into post-school activities, such as higher education, vocational training or employment (Hendricks & Wehman, 2009; Shattuck et al., 2012; Taylor & Seltzer, 2010). Individuals with Autism Spectrum Disorder ASD are less likely to be employed (34%) when compared with all individuals with disabilities (54%) and individuals without disabilities (83%) (Howlin, Goode, Hutton, & Rutter, 2004; Taylor & Seltzer, 2010). While the transition from school to the labour force is difficult, individuals with ASD who transition successfully to employment are often highly appreciated by their employers for their trustworthiness, reliability and low absenteeism (Hagner & Cooney, 2005; Hiillier et al., 2007). Some individuals with ASD also demonstrate exceptional strengths in their focus and meticulous attention to detail (Smith, Belcher, & Juhrs, 1995). Given the value employees with ASD add to the workplace, increasing employment rates of individuals with ASD is an aim of many governments' policies. For example, a priority of the Australian major Federal Government is to increase workforce participation for persons with disability, as outlined in the National Disability Strategy 2010–2020 (Council of Australian Governments, 2010).

Despite these initiatives, there is still a lack of effective career planning and adult support services for individuals with ASD, which has contributed to poor post-school outcomes (Attwood, 2007; Hendricks, 2010; Howlin, 2000). However, with optimal career planning, individuals with ASD can be successful in pursuing a range of careers which match strengths and interests (Hendricks, 2010). Career planning tools can enable this effective transition to employment in a number of ways. They can enhance the match between occupational roles and individual needs and strengths (Cobb & Alwell, 2009; Duffy &

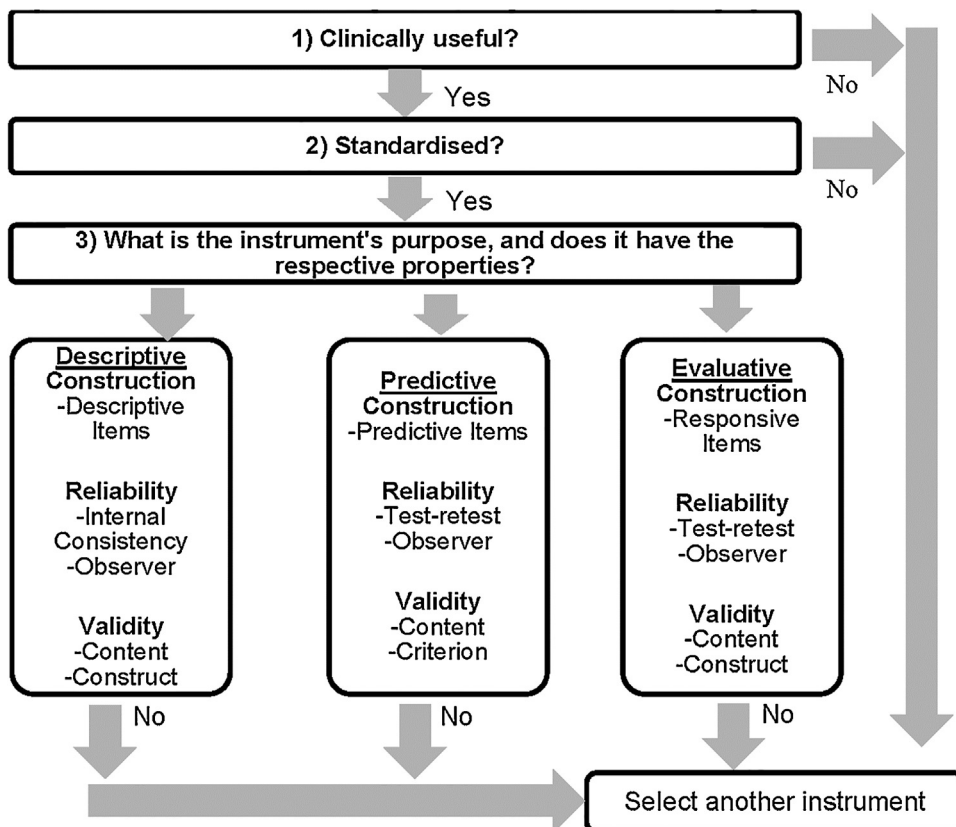


Fig. 1. Instrument evaluation process. A flow chart which directs the user to categorise the tool as descriptive, predictive or evaluative.

Murray, 2013; King, Baldwin, Currie, & Evans, 2005). They can also identify discrepancies between vocational demands and the individual's knowledge, resources and skills (King et al., 2005). While several studies have looked at interventions to assist young adults with disability in school to plan their transition out of school (Nicholas, Attridge, Zwaigenbaum, & Clarke, 2014; Taylor et al., 2012; Westbrook et al., 2013, 2012), at present no review has examined the available tools to assist with career planning for young adults with ASD.

An important consideration in evaluating career planning tools is the psychometric properties of the tool. However, the required psychometric properties for a tool vary depending on their purpose, or type. Tools can generally be categorised into three main types; descriptive, evaluative and predictive (Law, 1987). Descriptive tools are used to profile an individual at one point in time, and can be used for comparison between individuals (Law, 1987). Evaluative tools measure change in an individual over time. Predictive tools predict if an individual has a certain trait compared to pre-defined criteria. These tools predict the likelihood of a characteristic developing. The psychometric properties required for each type of tool are shown in Fig. 1. Therefore, it is important to identify the type of tool before evaluating the psychometric properties. Many tools used for career planning are predictive in nature. Predictive tools require test–retest and inter-rater reliability, and content and criterion validity to warrant use (Law, 1987).

Another important consideration in evaluating career planning tools is clinical utility, or whether the tool is practical and realistic to use. Clinical utility includes the cost of the tool, training required and administration time. It is important to evaluate both the psychometric properties and clinical utility to comprehensively appraise the appropriateness, feasibility and utility of a tool. A final consideration of career planning tools is whether they address important elements of effective career planning. One model describes five elements, including enhanced self-knowledge, skills and awareness of supports including social, internal and external (King et al., 2005).

2. Aim

This systematic review aimed to identify tools published in peer reviewed journals that could be utilised in career planning for individuals with ASD, and to describe their clinical utility, effectiveness in career planning and psychometric properties.

3. Method

The following procedure was used to identify articles for possible inclusion in this systematic review. Six international databases were searched for articles related to the topic: MEDLINE, CINAHL, EMBASE, Educational Resources Information Centre (ERIC), PSYCHinfo, and PROQUEST, from their earliest records up to May 2014, when the search was conducted. Initially, a search was conducted to find tools specifically for individuals with ASD. However, this search located an insufficient number of articles for a systematic review. Hence, the search terms were broadened to locate tools for individuals with a cognitive or developmental disability; and therefore tools that could potentially be utilised by individuals with ASD. The following key Boolean search terms were combined to search the above databases (disability or autism spectrum disorders or cognitive disorders or developmental disability) and (adolescent or young adult) and (tool or assessment or survey or questionnaire) and (career or employment or tertiary education or work experience).

The search was conducted with the assistance of an experienced librarian, who aided with truncation, expansion and adjustment of key search terms to match each database. For a full list of search terms, see Appendix A. Only peer-reviewed studies were included in this review. Studies were classified as peer-reviewed based on the hierarchy of evidence guidelines in the National Health and Medical Research Council in Australia (2000). In addition, articles were only included if they were written in English, and written after 1983, as this marks the year that Social Role Valorization Theory (Wolfensberger, 2011) was formulated, prompting the subsequent shift in values and attitudes towards individuals with a disability. After the initial search, abstracts were examined to see if they met the inclusion criteria. If abstracts did not provide sufficient information to decide if the study fulfilled the inclusion criteria, a full text analysis was conducted. Finally, a manual search of the reference lists from included studies was conducted to locate any additional studies that matched the inclusion criteria.

3.1. Inclusion/exclusion criteria

Studies were included in the current systematic review if they met the following inclusion criteria:

- a) The study included participants with a cognitive or developmental disability, including ASD. Studies that focused solely on physical, hearing, visual or mental health conditions were excluded, as these would have limited relevance to individuals with ASD.
- b) The study focused on career planning tools and assessed aspects of psychometric properties of the tools.

Studies were not included if they were addressing a broader research question. To determine reliability of article selection, two reviewers evaluated 50 randomly selected articles from the searches to determine whether they met inclusion

Table 1
Data extraction table.

Citation	Tool	Disability population					Method	Methodological quality	
		Diagnosis	# of participants	Age	Gender	Ethnicity			Recruitment location
(Ellerd, Morgan, & Salzberg, 2006)	YES Jobsearch program	ID	20	18–22, mean = 19	M = 10 F = 10	n.g.	Post high school program	Video CD-ROM program administered to participants to identify participants' desired job. Correspondence was then measured between above selection and job selected upon community visit. Lastly correspondence measured between video and a photograph of the job site.	Strong quality 85% (17/20). Study objective, design, inclusion/exclusion criteria and results sufficiently described. Blinding to intervention. Analyses appropriate. Statistical significance reported however small sample size. No outlined section for a conclusion, concluding statements partially reflected results.
(Morgan, 2008)	YES Jobsearch program	ID N = 17 ASD N = 1	18	17.1–21.9, mean = 18.2	M = 10 F = 8	n.g.	High school or post-high school	Facilitator and participant completed the assessment and result were analysed.	Adequate quality 67% (12/18). Study objective, design, subjects, outcome, analytic method, results and conclusion reported in sufficient detail. Poor sampling technique and small sample size.
(Morgan, 2011)	YES Jobsearch program	ID	21	18–21, mean = 19.8	n.g.	n.g.	High school transition program	Inter-rater reliability of the job-matching tool assessed between job coach and special education teacher (form filled in on the behalf of the participant) were correlated.	Adequate quality 50% (10/20). Study objective, design, outcome measure and results described in sufficient detail. Limited evidence of inclusion/exclusion criteria and demographics. Small sample size. Variance had the potential to be reported and was not evident. No conclusion.
(Morgan, 2003)	YES Jobsearch program	Emotional disturbances, traumatic brain injury, developmental disability, LD and other.	56 (20 participants were utilised for assessing criterion validity)	12–22, mean = 17	M = 33 F = 23	Caucasian = 36 Hispanic = 13 African American = 7	Transition program	Facilitator administered the CD-ROM video assessment and then re-assessed the CD-ROM video assessment in approximately 60 days. Further assessed criterion validity by administering the reading-free vocational interest inventory and comparing results to CD-ROM video assessment.	Strong quality 94% (17/18). Objective, design, method of selection, subjects, outcome, analytic method, results and conclusion were appropriate and reported sufficiently. Sample size appropriate for test retest, however small sample size assessed criterion validity (N = 20).
(Lattimore, Parsons, & Reid, 2003)	Pre-work multiple stimulus assessment	ASD, combined with multiple disabilities	5	26–38, mean = 30	M = 5 F = 0	n.g.	Worksite	Pre-work assessment conducted. Results collated to determine preferred verse non-preferred tasks of cleaning. Validated via an on-the-job preference assessment.	Adequate quality 56% (10/18). Study objective, design, outcome measure and results reported in sufficient detail. Limited evidence of method selection. Minimal demographic details. No analytic methods used. Poor sample size. No conclusion.
(Lattimore, Parsons, & Reid, 2002)	Pre work paired-task assessment	ASD with various comorbidities.	3	25–29, mean = 26.6	M = 3 F = 0	n.g.	Worksite	Workers presented with choices (materials signifying job task) repeated in pairs, highest frequency of chosen task was determined.	Adequate quality 50% (9/18). Objective, design, outcome measures, reported in sufficient detail. Limited detail on subject selection, demographics. Poor

Table 1 (Continued)

Citation	Tool	Disability population					Method	Methodological quality	
		Diagnosis	# of participants	Age	Gender	Ethnicity			Recruitment location
(Reid, Parsons, & Green, 1998)	Same as above	Multiple disabilities	Same as above	30–73, mean = 50.6	M = 2 F = 1	n.g	Worksite	Same as above	sample size. No analytic methods used. No conclusion. Same as above
(Cobigo et al., 2009)	Work task preference assessment	ID	19	23–58, mean = 35	M = 11 F = 8	n.g	Disability agency	Participants completed assessment. Frequency of chosen task and behaviours elicited were recorded.	Good quality 78% (14/18). Study objective, design, outcome measure, analytic method, results and conclusion reported in sufficient detail. Poor evidence in subject selection no inclusion/exclusion or total pool of potential applicants. Sample size not discussed however 19 participants is relatively small.
(Dipeolu, 2007)	Career maturity inventory revised (CMI-R)-career thoughts inventory (CTI)-my vocational self (MVS)	LD	86	14–18, mean = 16.16	M = 62 F = 24	Caucasian = 61% African American = 16.8% Hispanic = 12.6% Native American = 4.2% Asian = 1.1%	High school	Participant completed the 3 assessments. Results correlated and compared to normative data.	Strong quality 85% (17/20). Study objective and design clearly identified. Inclusion/exclusion criterion was not sufficiently described. Good sample size. Results reported sufficiently. Variation in results reported. Analytic method appropriate. No conclusion.
(Dipeolu, Hargrave, Sniatecki, & Donaldson, 2012)	CTI, CMI-R and MVS	LD	139	14–20, mean = 16.4	M = 100 F = 39	Caucasian = 71% African American = 13% Hispanic = 8% Native American = 6.5% Asian = 1.5%	High school	Same as above	Strong quality 83% (15/18). Objective, subject selection, subjects, analytic method, variance reports, results were appropriate and reported in sufficient detail. Limited detail on study design. Sample size seemed appropriate.
(Gal, Meir, & Katz, 2013)	Autism work skill questionnaire	High functioning ASD	46	18–39, mean = 25.32	M = 36 F = 10	n.g	Work agency	Questionnaire developed. Partial or no agreements to questions were discussed till an agreement was made. Questionnaire administered to participants results collated to measure psychometric properties.	Strong quality 83% (15/18). Study objective, design, method of subject, outcome measures, results and conclusion sufficiently described. Limited demographic information on subjects. Moderate sample size, discussed as a limitation to the study.
(Mattie, 2000)	Holland's self-directed search	3 populations; LD (reading and non-reading) and developmental disability.	337	13–21, mean = 15.7	M = 219 F = 118	Caucasian = 195 African American = 39	High school	Assessment administered to participants. Test scores evaluated assessing internal consistency reliability, category sensitivity, similarity and frequency distributions.	Strong quality 82% (18/22). Objective, design, subjects, outcome measure, sample size, analytic method, results and conclusion were appropriate and reported in sufficient detail. Limited evidence of inclusion/exclusion criteria and method selection.
		ID	69	n.g		n.g			

(Rose, Perks, Fidan, & Hurst, 2010)	Work readiness scale					M = 34 F = 35		Vocational training centre and employment agency	Work readiness scale (WRS) administered to participants. WRS re-administered in two weeks' time (assess test/re-test reliability). Cronbach's alpha assessed internal consistency. Staff completed motivational scale of participants this was correlated to WRS scale total (construct validity).	Good quality 78% (14/18). Study objective, design, method, outcome measures, analytic method and results reported in sufficient detail. Limited information on demographics of participants. Moderate sample size. No conclusion.
(Tryjankowski, 1987)	5 work samples from Jewish employment and vocation services) (JEVS work Sample)	LD	36	13-15, mean = 14.4	M = 30 F = 6	Caucasian = 28 African American = 5 Other = 3		Pre-vocational training centre	Correlate variables which measure convergent and discriminant validity against traits (visual memory, visual discrimination, auditory discrimination, auditory to visual motor coordination and visual motor coordination) and measurements (JEVS work sample, specific language disabilities test and Wechsler intelligence test for children-revised).	Strong quality 81% (13/16). Objective, design, results, method of subject selection, subjects, results, analyse methods were appropriate and sufficiently reported. Moderate sample size, not specifically discussed. No conclusion.

criteria. An inter-rater reliability score of $K_w = 0.762$ (standard error = 0.093) was attained using weighted kappa percentage agreement, indicating adequate reliability.

3.2. Methodological quality

The methodological quality of the included articles was evaluated using the assessment tool for quantitative studies developed by Kmet et al. as shown in [Appendix B \(Kmet, Lee, & Cook, 2004\)](#). The checklist comprised of 14 questions with a corresponding scoring system. The manual provided comprehensive instructions for scoring each aspect. The quality of each article was then rated as being strong (>80%), good (70–80%), adequate (50–69%) or limited (<50%). The Kmet scores were independently reviewed by two separate researchers. Kmet scores are provided in [Table 1](#).

3.3. Data extraction

Data extraction followed the guidelines provided by the Cochrane Handbook for Systematic Reviews Section 7.3.a ([Higgins & Green, 2011](#)). Data was extracted for the following areas; citation, tool, disability population (diagnosis, number of participants, age, gender, ethnicity and area which participant was recruited from), method, and methodological quality, as shown in [Table 1](#).

Psychometric properties of the tools were classified as poor, adequate, good or strong in accordance with guidelines provided in [Portney and Watkins \(2009\)](#) for each analysis technique. Clinical utility of the included tools was not discussed in the articles. Hence, information was located by email correspondence with the authors and manual searches via online search engines. In addition, two librarians from the Curtin University manually searched a resource database (AMLIB at the resource learning centre).

3.4. Data synthesis and analysis

A narrative approach to synthesise and analyse the data was used. This approach was beneficial in assessing methodological issues and interpreting and structuring all results. The synthesis of the data was categorised into four main themes; type of tool, clinical utility, reliability and validity.

4. Results

Electronic searches located a total of 2348 articles, which included 228 articles from MEDLINE, 174 from PROQUEST, 798 from ERIC, 315 from EMBASE, 343 from CINAHL and 490 from PSYCHinfo. The process of appraising these articles is displayed in [Fig. 2](#). Screening was then conducted, which involved duplicates being removed to leave a total of 2187, and then the removal of articles which were not peer-reviewed, leaving 1205 journal articles. The abstracts of these articles were reviewed to determine if they met inclusion criteria. A total of 70 articles met inclusion criteria. Full text articles were then examined against the inclusion criteria, which resulted in 13 articles. Reference lists of these articles were examined, and one more article that met the criteria was included. Therefore, a total of 14 journal articles were included in the current review.

4.1. Quality assessment of studies

All studies identified were descriptive and utilised mixed methodologies. An overall total of 832 participants were included in the 14 articles, as presented in the [Table 1](#).

The methodological quality of the studies ranged from adequate: to being at 50% though, to strong as assessed by the Kmet ([Kmet et al., 2004](#)), as shown in [Table 1](#). All studies reported results sufficiently, and study designs were described in sufficient detail and were appropriate for evaluating the tools. However, many studies had the limitations of small sample sizes and limited information about sampling strategies. In addition, not all studies discussed methods for analysis, but those which did discuss analysis used appropriate and thorough methodology.

4.2. Types of tools

Ten career planning tools were identified within the 14 articles. The purpose of the tools was to assist with career planning for individuals with cognitive or developmental disability, including ASD. All of the 10 tools were predictive in nature. [Table 2](#) provides an overview of each of these tools, including a description of the targeted disability group, tool type, domain of career planning and measurement technique utilised.

The tools identified in the articles varied in when they had been developed. Seven of the ten tools were developed within the last ten years. These tools were all described in the literature from 2006 to 2013, and were: the *YES Jobsearch Program*, *Work Task Preference*, *Career Maturity Inventory*, *Career Thoughts Inventory*, *My Vocational Skills*, *Autism Work Skill Questionnaire* and *Work Readiness scale*. The three remaining tools were identified in publications from 1987 to 2003; the *Prewrite Multiple Stimulus Assessment*, *Hollands Self-directed Search* and *Jewish Evaluation of Five Vocational Work Sample*.

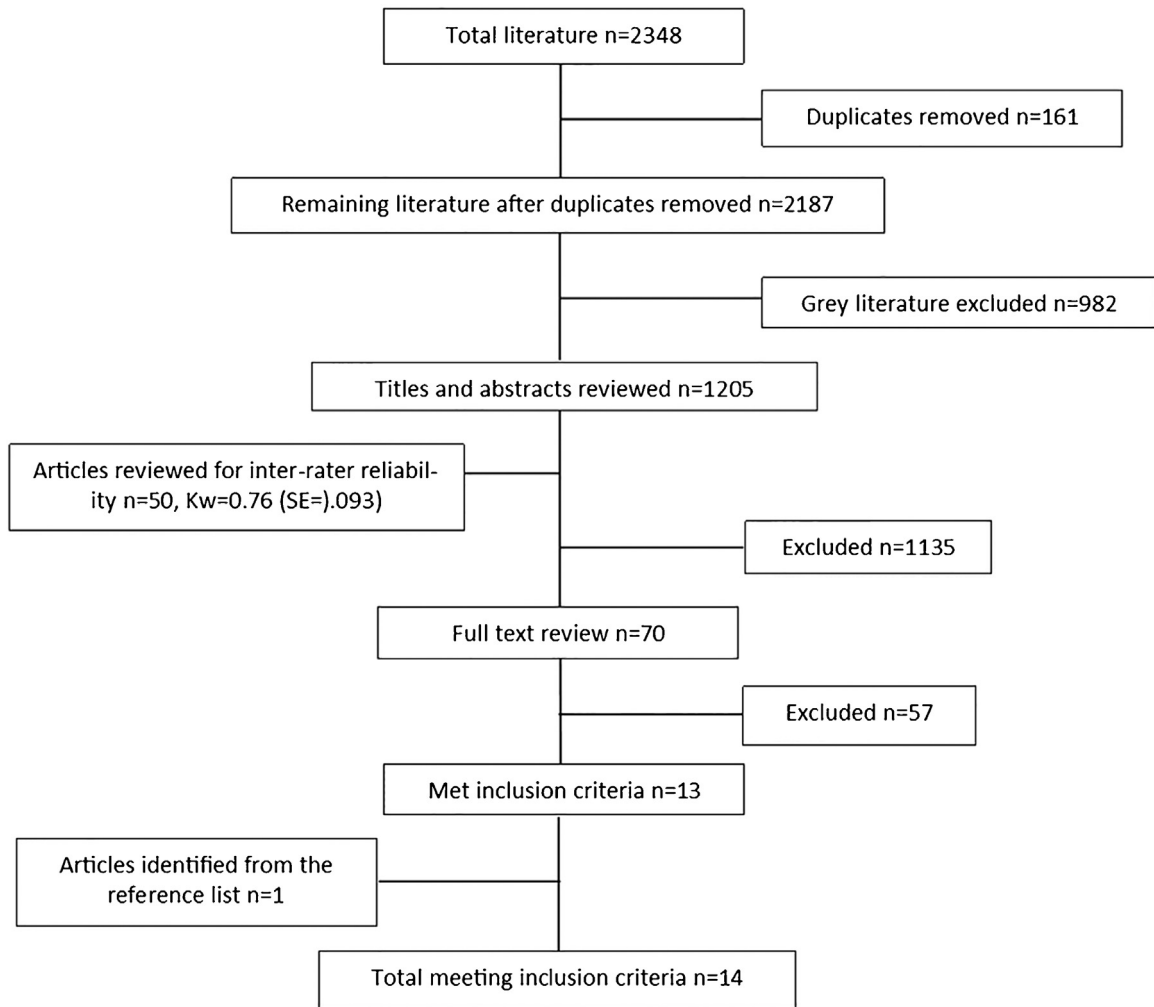


Fig. 2. Selection of studies represented by flow chart. Quantifies the total literature searched (2348) through to the final articles meeting inclusion criteria (14).

The tools were developed for use by a variety of disability groups. Five tools focused on individuals with learning disability, including the *Career Maturity Inventory*, *Career Thoughts Inventory*, *My Vocational Skills*, *Holland's Self-directed Search* and *Jewish Evaluation of Five Vocational Work Sample*. Individuals with intellectual disabilities were the focus of three of the tools; the *Work Task Preferences*, *YES Jobsearch Program* and *Work Readiness Scale*. The final two tools were developed for individuals with ASD; including the *Autism Work Skill Questionnaire* and *Pre-work Multiple Stimulus Assessment*.

Two main measurement techniques were used in the tools. Six tools used a questionnaire format; the *Career Maturity Inventory*, *Career Thoughts Inventory*, *My Vocational Skills*, *Autism Work Skills Questionnaire*, *Holland's Self-directed Search* and *Work Readiness Scale*. The remaining four tools used work samples or examples (images or videos) to determine skill preference and strengths; including the *YES Jobsearch Program*, *Work Task Preference Assessment*, *Pre-work Multiple Stimulus Assessment* and *Jewish Evaluation of Five Vocational Work Sample*.

Each tool focused on a different domain of career planning. Three of the tools assessed career preferences; these were the *Work Task Preference*, *YES Jobsearch Program* and *Pre-work Multiple Stimulus Assessment*. Three tools assessed strengths and weaknesses associated with vocational success; *Autism Work Skill Questionnaire*, *Holland's Self-directed search* and *Jewish Evaluation of Five Vocational Work Sample*. The remaining four tools assessed perceptual factors which impact on vocational success; *Work Readiness Scale*, *Career Maturity Inventory*, *Career Thoughts Inventory* and *My Vocational Skills*.

4.3. Clinical utility

Information relating to clinical utility was located for five of the tools; *YES Jobsearch program*, *Work Task Preference Assessment*, *Career Thoughts Inventory*, *Autism Work Skill Questionnaire* and *Holland's Self-Directed Search*. It was not possible to

Table 2
Career planning tools.

#	Tool	Disability	Tool type	Description and measurement technique	Domain of career planning
1	YES Jobsearch Program (Ellerd et al., 2006; Morgan, 2003; Morgan, 2008, 2011)	Primarily ID	Predictive	Work samples/examples; short video clip viewed entailing information about vocations. Participants choose preferred vocation. Facilitator assigned weighting to 106 dimensions, for example math skills or computer skills. Job match is computed from the weightings assigned to the job dimension and preference choice by participant.	Career preferences: an interest inventory. Vocational preferences assessed against participant's strengths and weaknesses.
2	Pre-work Multiple Stimulus Assessment (Lattimore et al., 2003; Lattimore et al., 2002; Reid et al., 1998)	ASD with various comorbidities	Predictive	Work samples/examples; five different items are presented to participant representing different domains of a job, for instance cleaning; a vacuum cleaner, duster, polishing cloth, mop and broom presented. Participant chooses preferred task. Participant then performs job for three minutes and the process is repeated. The frequency of selected job tasks is measured.	Career preferences: vocational preference for domains of a particular vocation.
3	Work Task Preference Assessment (Cobigo et al., 2009)	ID	Predictive	Work samples/examples; four task options made available in which two simultaneous objects or pictures representing job task are presented to participant, totalling six possible pairs. Participant chooses preferred and performs this task for a three minute period. Pairs are presented over six sessions; frequency of selected job task is measured.	Career preferences: vocational preference for domains of a particular vocation.
4	Career Maturity Inventory-Revised (Dipeolu, 2007; Dipeolu et al., 2012)	LD	Predictive	Questionnaire; a 50 item questionnaire made up of two sub scales; <i>attitude scale</i> and <i>competency test</i> , both are 25 questions, with response style; agree and disagree. Participant scores measured against correct scores.	Perceptual factors: career maturity.
5	Career Thoughts Inventory (Dipeolu, 2007; Dipeolu et al., 2012)	LD	Predictive	Questionnaire; A 48 item tool made up of 3 subscales; <i>decision making confusion scale</i> (14 items), the <i>commitment anxiety scale</i> (14 items) and <i>external conflict scale</i> (10 items). Scored on a four point Likert scale (strongly disagree = 1 to strongly agree = 4), raw score is translated to t score.	Perceptual factors: Dysfunctional career thoughts.
6	My Vocational Skills (Dipeolu, 2007; Dipeolu et al., 2012)	LD	Predictive	Questionnaire; Made up of 3 subscales; <i>Vocational Identity</i> , 18 true or false questions, higher number of false equals increased vocation identity, <i>occupation Information</i> , subjective response to four questions of needs for vocation information, <i>barriers</i> , subjective response to four questions about constraints preventing occupational goal.	Perceptual factors: Vocational identity.
7	Autism Work Skill Questionnaire (Gal et al., 2013)	ASD	Predictive	Questionnaire; 78 item questionnaire, participant's rate response on 5 point Likert scale (1 very low to 5 very high). Made up of six domains <i>work habits</i> (12 items), <i>working style</i> (10 items), <i>independence in work and study</i> (10 items), <i>sensory response and needs</i> (13 items), <i>routine daily activities</i> (14 item) and <i>interpersonal skills</i> (19 item).	Strengths and weaknesses: Linked to vocational success.
8	Holland's Self-directed Search (Mattie, 2000)	LD and developmental disabilities	Predictive	Questionnaire; created on the basis of the belief there are 6 personality types; investigative, realistic, social, artistic, conventional and enterprising types and these personalities seek particular environments. It is a self-administered, self-marked and self-interpreted assessment	Strengths and weaknesses: occupational interests and preferences.
9	Work Readiness Scale (Rose et al., 2010)	ID	Predictive	Questionnaire; 13 item scale, rated on a five point Likert scale, visual prompt cards embody faces ranging from strongly disagree to strongly agree.	Perceptual factors: motivation for work (career maturity).
10	Jewish Evaluation of Five Vocational Work Sample (Tryjankowski, 1987)	LD	Predictive	Work samples/examples; Participants perform five types of work and a facilitator marks if each step is correct.	Strengths and weaknesses: identifies aptitudes, abilities and skills required for vocations.

Table 3
Clinical utility.

#	Tool	Cost	Training	Administration time
1	YES Jobsearch Program	\$20 (USD) for online subscription, unlimited access for 3 months. \$395 (USD) for CD-ROM version, including 7CD-ROMs, 300 page manual and 20 job preference summary sheets.	No training required. Program comes with a facilitation manual.	Approximately 20–30 min.
2	Work Task Preference Assessment	\$40 (CAD) for the manual.	\$1000 (CAD) for a one day training session.	7 × 20 min sessions, can be completed on different days.
3	Career Thoughts Inventory	\$250 (USD) introductory kit. Refill costs were unspecified.	Not known	7–15 min (self-administered) 3–5 min required for marking.
4	Autism Work Skill Questionnaire	This tool is still being developed and is not commercially available.	Training available in Jerusalem and is in Hebrew. Cost of training unknown.	Not known.
5	Holland's Self-directed Search	\$199 (USD)	Not known.	25–30 min (self-administered) 10 min to mark.

locate information about the clinical utility of the remaining four tools. The clinical utility for each of the tools is described in Table 3; including cost, training and administration time.

Information about cost was identified for four of the tools. The *YES Jobsearch program* is \$20 (USD) for a three month online subscription, or \$395 (USD) for the CD-ROM version. The *Work Task Preference Assessment* manual costs \$40 (CAD). The *Career Thoughts Inventory* introductory kit costs \$250 (USD), refill costs unspecified. The *Holland's Self-directed Search* costs \$199 (USD). The *Autism Work Skill Questionnaire* is still in development, and therefore the cost remains unknown as it is not yet commercially available.

Information regarding training was located for three tools. The *YES Jobsearch program* requires no training. The *Work Task Preference Assessment* requires one full day of training, which costs \$1,000 (CAD). There is training available for the *Autism Work Skill Questionnaire*, however it is only currently available in Jerusalem, and the cost for this training is unknown.

Administration time was identified for three tools. The *YES Jobsearch program* takes approximately 20–30 min to administer. The *Work Task Preference Assessment* is completed in 7 sessions, running for 20 min each. The *Career Thoughts Inventory* is self-administered, and takes 7–15 min to complete, and 3–5 min to score. Lastly, *Holland's Self-Directed Search* can be self-administered in 25–30 min, and scored in 10 min.

Table 4
Reliability of tools.

#	Tool	Inter-rater or inter-observer	Test-retest	Internal consistency
1	YES Jobsearch Program (Ellerd et al., 2006; Morgan, 2003; Morgan, 2008, 2011)	Good–strong: 0.71 (2011) and 1.0 (2003)	Strong: kappa = 0.93 and 0.72 for work conditions and job choice respectively.	
2	Pre-work Multiple Stimulus Assessment (Lattimore et al., 2003; Lattimore et al., 2002; Reid et al., 1998)	Strong: 1.0 agreement		
3	Work Task Preference Assessment (Cobigo et al., 2009)	Strong: 0.85 agreement		Poor–adequate: no significant difference in behaviours however adequate consistency between preferred and chosen task, correlation equals 0.63. Good–strong: Pearson-product correlation; 0.80 (2007) and 0.77 (2012).
4	Career Maturity Inventory- Revised (Dipeolu, 2007; Dipeolu et al., 2012)			Strong: Pearson-product correlation; 0.96 (2007) and 0.95 (2012).
5	Career Thoughts Inventory (Dipeolu, 2007; Dipeolu et al., 2012)			Strong: Pearson-product correlation; 0.84 (2007) and 0.82 (2012).
6	My Vocational Skills (Dipeolu, 2007; Dipeolu et al., 2012)			Adequate–strong: Cronbach's alpha = 0.65–0.90.
7	Autism Work Skill Questionnaire (Gal et al., 2013)			
8	Holland's self-directed Search (Mattie, 2000)	Strong: 1.0 agreement between teachers and compliance to manual		Good: alpha coefficient; male LD readers 0.71, male LD non-readers 0.70 and developmental disability 0.70, female LD readers 0.70, female LD non-readers 0.64 and female developmental disability 0.69.
9	Work Readiness Scale (Rose et al., 2010)		Good: $P = 0.02$	Poor–good: poor between subscales good between full scale; Cronbach's alpha = 0.73.

4.4. Reliability

Reliability of the tools was determined in some of the studies. The different areas of reliability for each of the tools are shown in Table 4, including inter-rater, test re-test and internal consistency reliability.

Inter-rater reliability was determined for four of the tools, and all were rated as being strong. The tools were the *Work Task Preference Assessment*, *Pre-work Multiple Stimulus*, *YES Jobsearch program* and *Holland's Self-directed Search*. Two tools were assessed on their test–retest reliability. These tools ranged from having good to strong test–retest reliability; and included

Table 5
Validity of tools.

Tool	Face Validity	Predictive Validity	Criterion Validity	Construct Validity
1 YES Jobsearch Program (Ellerd et al., 2006; Morgan, 2003; Morgan, 2008, 2011)	–	–	Poor–adequate: low correlation between similar tools, no significant difference, $P=0.5$, effect size = 0.16, however adequate results in correlation of highest preferences between tools, statistically significant ($P < 0.01$, effect size = 0.61).	Strong: video choices represented choices made from community visit and photos; expected proportion; $P=0.002$ and $P=0.001$, respectively
2 Pre-work Multiple Stimulus Assessment (Lattimore et al., 2003; Lattimore et al., 2002; Reid et al., 1998)	–	Strong: 0.98 (2003) 0.65 (2002) and 0.75 (1998) of participants chose previously assessed preferred vocation on first choice, however strong variability in second and third choice.	–	–
3 Work Task Preference Assessment (Cobigo et al., 2009)	Strong: validated by expert panel of five individuals from intellectual disability field.	–	–	–
4 Career Maturity Inventory-Revised (Dipeolu, 2007; Dipeolu et al., 2012)	–	–	Poor–strong: significant difference in scores from the manual comparative to LD participants, indicating the need for a normed scale for the LD population. Journal articles collectively assessed validity of the CMI-R, CTI and MVS; results matched hypothesis (strong). Except one contrary result; as MVS (subscale; occupational information) increased, CTI (subscale; commitment anxiety) increased $P=0.05$.	–
5 Career Thoughts Inventory (Dipeolu, 2007; Dipeolu et al., 2012)	–	–	Poor–strong: refer above	–
6 My Vocational Skills (Dipeolu, 2007; Dipeolu et al., 2012)	–	–	Poor–strong: refer above	–
7 Autism Work Skill Questionnaire (Gal et al., 2013)	Strong: experts agreement on questions equalled 86–100.	–	–	–
8 Holland's Self-directed Search (Mattie, 2000)	Good: no significant difference between normed population scores verse LD and developmental disability population, $P=0.05$.	–	–	–
9 Work Readiness Scale (Rose et al., 2010)	–	–	–	Good: participant scores representative of staff scores ($P=0.05$).
10 Jewish Evaluation of Five Vocational Work Sample (Tryjankowski, 1987)	Adequate: work samples represent 'real life' indicating face validity.	–	–	Three out of five samples found strong construct validity.

Note: content validity was not evaluated in any of the journal articles.

the *YES Jobsearch Program* (strong) and *Work Readiness Scale* (good). Internal consistency was evaluated for seven of the tools, and ratings ranged from poor to strong in this area. The tools were the *Work task Preference Assessment* (poor–adequate), *Career Maturity Inventory* (good–strong), *Career Thoughts Inventory* (strong), *My Vocational Skills* (strong), *Autism Work Skill Questionnaire* (adequate–strong), *Holland's Self-directed Search* (good) and *Work Readiness Scale* (poor–good).

4.5. Validity

The validity of the tools was explored in a number of studies. Table 5 outlines the validity of the tools in the following areas: face, predictive, criterion and construct. Content validity was not evaluated in any of the journal articles.

Face validity was determined for four of the tools, which all received a rating of adequate to strong; including the *Work Task Preference* (strong), *Autism Work Skill Questionnaire* (strong), *Holland Self-directed Search* (good) and *Jewish Evaluation of Five Vocational Work Samples* (adequate). Predictive validity was evaluated in one tool as strong; *Pre-work Multiple Stimulus*. Criterion validity was rated between poor and strong for four of the tools; *YES Jobsearch Program* (poor–adequate), *Career Maturity Inventory* (poor–strong), *Career Thoughts Inventory* (poor–strong) and *My Vocational Skills* (poor–strong). Lastly, construct validity was determined for three tools, which were rated between good and strong; *YES Jobsearch Program* (strong), *Work Readiness Scale* (good) and *Jewish Evaluation of Five Vocational Work Samples* (strong).

5. Discussion

Career planning tools can assist individuals with ASD to find employment by identifying discrepancies between vocational demands and the individual's knowledge, resources and skills (Cobb & Alwell, 2009; Duffy & Murray, 2013; King et al., 2005). Unfortunately, very few existing career planning tools have been developed specifically for individuals with ASD. Therefore, the current review included career planning tools that had been used by individuals with a cognitive or developmental disability, which could also be utilised by individuals with ASD. The majority of the tools were developed for individuals with learning disabilities and intellectual disabilities, only two tools were developed specifically for individuals with ASD. This further highlights the need for more ASD specific tools to be developed, as it appears that this group faces specific challenges in their career planning (Hendricks, 2010).

The methodological quality of the articles was varied. The strength of many studies was the detailed description of design and results. Analysis techniques described in the studies were appropriate and relevant. Small sample size was the primary limitation of the majority of studies. However, this is common in these types of studies due to the difficulty in recruiting participants. Furthermore, sampling techniques employed in the studies could be improved, as only one study randomised its participant selection (Tryjankowski, 1987). The sampling technique limits the ability to collate normative data for the population, which is necessary for standardising these tools. The study designs were low level evidence, according to the hierarchy of evidence (National Health and Medical Research Council, 2000). However, this study design was appropriate for the purpose of the studies, which was to determine the psychometric properties of the tools.

The clinical utility of a tool is important to consider, since for it to be useful it must be practical to use, cost effective and accessible to the wider community. Information about clinical utility could only be located for five of the tools, despite sourcing this information in the way consumers would likely access information about the tools (emails and online engine searches). In addition, information relating to clinical utility was incomplete for most of these five tools. Only two tools addressed all three categories of clinical utility; the *Work Task Preference Assessment* and *YES Jobsearch Program*. It was difficult to compare the costs of the tools due to the varied nature of the pricing. For example, one purchase price was all-inclusive, another was for an introductory kit and one placed a time restriction on access to three months. Only two tools provided information about training. The *YES Jobsearch Program* had the best utility in this area, as it required no training in comparison to the *Work Task Preference Assessment* which costs \$1000 for one day of training. In terms of administration time, the *Career Thoughts Inventory* can be self-administered and it was the quickest to complete and score. The tools identified were mostly developed in the past ten years. The clinical utility of the three tools developed prior to this could be questioned, when considering the significant changes in technology and in the disability sector within the past ten years. Overall, the limited information available on the clinical utility of the tools restricts discussion about which tool is the most clinically useful. As clinical utility is an important element of tool efficacy, there is need for future research in this area.

The establishment of strong psychometric properties for these tools is crucial in ensuring their usefulness and effectiveness. Some of the tools described in this study have areas of strong reliability and validity. As discussed previously, tools require different psychometric properties depending on their purpose; whether they are descriptive, predictive or evaluative. All of the tools described in the current review are predictive in nature. However, when appraising these tools using the Instrument Evaluation Process (Fig. 1), none of them meet the full requirements for reliability and validity suggested for predictive tools. The *YES Jobsearch Program* demonstrated the strongest psychometric properties as required for predictive tools. This tool evaluated three out of the possible four properties. However, poor criterion validity results suggest further research is required. The limited evaluation of psychometric properties for disability specific tools appears to be recurrent in the literature (DeVon et al., 2007; Karak, Bialocerkowski, Massy-Westropp, Kumar, & Grimmer, 2004). To improve confidence in disability-specific tools more rigorous analysis of psychometric properties is required.

Effective career planning tools should encompass the five elements of career planning (King et al., 2005), as described previously. These include improved knowledge of self and future self, enhanced skills, increased knowledge, heightened

awareness of support and an enhanced supportive environment. All of the reviewed tools addressed the element of 'improved knowledge of self and future self' by providing feedback about the skills, aiming to increase self-awareness. Some tools support the elements of 'increased knowledge' and 'enhanced skills', by providing insight into the individual's strengths and weaknesses. For example, *My Vocational Skills* provides the opportunity to explore and become more aware of individual support needs. Only *My Vocational Skills* assists in 'enhanced supportive environment' by identifying extrinsic and intrinsic occupational barriers. Overall, *My Vocational Skills* emerged as the only tool which encompassed all five elements of career planning. This tool utilises a client-centred approach, which is a core element that enables effective transition.

A limitation of this review is that none of the primary studies included Rasch analysis, which ensures the total score on an assessment is an exhaustive and complete representation of the variable it is attempting to measure. As these studies did not use Rasch analysis for the tools identified, it is unclear whether the total score adequately represents the construct of interest, or whether the tools have floor or ceiling effects. In addition, some included articles were written by the people who developed the tool (Cobigo, Morin, & Lachapelle, 2009; Ellerd et al., 2006; Gal et al., 2013; Lattimore et al., 2002; Lattimore et al., 2003; Morgan, 2003; Morgan, 2008; Morgan, 2011; Reid et al., 1998; Tryjankowski, 1987). It is important to keep in mind that this could have introduced author-bias in the reporting of the results in these studies. Furthermore, forward searching of the literature was not conducted; however of the tools included several had multiple articles written by the same author. Unfortunately, there was a lack of information about the tools' clinical utility. The need to research this further was briefly mentioned in the included studies. This could be the focus of future research in this area, as clinical utility is an important element in tool selection.

6. Conclusion

Ten predictive career planning tools were identified. However, none of the tools had strong reliability or validity in the areas required for predictive tools. In addition, only two of these are specifically designed to be used by individuals with ASD. Furthermore, little is known about the clinical utility of each of the tools. The tools included in this review could potentially be of value for individuals with ASD. However, before these tools are used extensively in clinical practice, further research should be conducted looking at the psychometric properties and clinical utility of the tools, and adapting the tools to specifically meet the needs of individuals with ASD.

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Appendix A.

Search terms

Asperger Syndrome OR Pervasive Developmental Disorders OR Neurological Impairments OR Attention Deficit Disorders OR Epilepsy OR Communication Disorders OR Disabilities OR Cerebral Palsy OR Learning Disabilities OR Mental Retardation OR Developmental Disabilities OR Minimal Brain Dysfunction OR Mental Disorders OR Language Impairments OR Behaviour Disorders OR Aphasia OR Speech Impairments OR Multiple Disabilities OR Autism OR Perceptual Impairments AND Early Adolescents OR Adult Students OR Adults OR Young Adults OR Adolescents OR Late Adolescents OR Youth AND State Surveys OR Career Counselling OR Online Surveys OR Guidance OR Attitude Measures OR Surveys OR Student Surveys OR Career Guidance OR Mail Surveys OR Job Analysis OR Statistical Surveys OR Curriculum Based Assessment OR Informal Assessment OR Functional Behavioural Assessment OR Student Evaluation OR Psychological Evaluation OR Interest Inventories OR Community Surveys OR Measures Individuals OR Rating Scales OR Vocational Evaluation OR Telephone Surveys OR Questionnaires OR Needs Assessment OR Tests OR Alternative Assessment OR Task Analysis OR Skill Analysis OR Educational Assessment OR Affective Measures OR Performance Based Assessment OR Personality Measures OR Evaluation OR Occupational Surveys OR Evaluation Methods OR Personality Assessment OR School Surveys OR Interviews OR career awareness OR vocational interest OR career counselling OR career development OR career guidance OR career exploration OR vocational aptitude OR career planning OR career education OR occupational tests OR career choice OR career planning AND Career Development OR Work Study Programs OR Professional Development OR Supported Employment OR Part Time Employment OR Careers OR Professional Education OR Career Academies OR Undergraduate Study OR Universities OR

¹ Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Queensland, Australia.

² Curtin Library, Curtin University, Perth, Western Australia, Australia.

Sheltered Workshops OR Professional Occupations OR Professional Identity OR High Schools OR Employment Programs OR Work Experience OR Higher Education OR Underemployment OR Colleges OR Work Experience Programs OR Employment Interviews OR Employment OR Workplace Learning OR Postsecondary Education OR Youth Employment OR Graduate Study OR Employment Experience OR Vocational Education OR Career Opportunities OR Student Employment OR Vocational Schools OR Vocational Training Centers OR Occupations OR Cooperative Education OR Vocational High Schools OR Off the Job Training OR Career Readiness OR Job Skills OR Volunteer Training OR Job Training OR On the Job Training.

Appendix B.

Kmet form (Kmet et al., 2004)

Criteria	Yes (2)	Partial (1)	No (0)	N/A
1 Question/objective sufficiently described?				
2 Study design evident and appropriate				
3 Method of subject/comparison group selection or source of information/input variables described				
4 Subject (and comparison group, if applicable) characteristic sufficiently described?				
5 If interventional and random allocation was possible, was it described?				
6 If interventional and blinding of investigation was possible was it reported?				
7 If interventional and blinding of subjects was possible, was it reported?				
8 Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias/ means of assessment reported?				
9 Sample size appropriate?				
10 Analytic method described/justified and appropriate?				
11 Some estimates of variance is reported for the main results?				
12 Controlled for confounding				
13 Results reported in sufficient detail?				
14 Conclusion supported by the result				

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