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Assessment tools for the career planning of adolescents and adults with neurodevelopmental disorders: a systematic review

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ABSTRACT

Background: Vocational outcomes for people with Neurodevelopmental Disorders (ND) are generally limited. When planning a career path for this population, it would seem essential to consider employability as a complex process that is challenging for the individual with ND because it depends on many skills and how they match the work environment.
Methods: We systematically reviewed the scientific contributions in the literature describing procedures for assessing work preferences and interests, soft skills and other relevant interpersonal skills, and job matching for adolescents and adults with ND. Specifically, this review aims to explore these assessment strategies to help mental health professionals design a career pathway for people with ND. The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines were followed, using PsycInfo, Scopus, Web of Science, and Pub Med. A total of 22 papers were included in the final analysis.
Results: The results showed no pre-employment assessment procedures for individuals with ND that are strongly scientifically validated to date. However, an assessment that includes self-report tools and computer-based procedures for assessing work preferences, job matching, and soft skills could help people with ND develop a sense of self-efficacy about their abilities.
Conclusions: The results are discussed in terms of implications for professional practice and future research perspectives.

Keywords: *Neurodevelopmental disorders; Assessment; Soft skills; Job preferences; Job matching ;*

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Introduction

Work has multiple positive effects on the quality of life for all people, including providing an economic income, the opportunity to form relationships, an increase in self-esteem, and a sense of having a goal in life, so much so that people often construct their identity based on their occupations (Davies, Stock, Davies, & Wehmeyer, 2018). In recent years, vocational rehabilitation professionals have placed greater emphasis on providing young people and adults with Neurodevelopmental Disorders (ND) with the opportunity to identify the preferences necessary to shape their career paths (Hall, Morgan, & Salzberg, 2014). Indeed, one of the assumptions underlying the most innovative job placement and career planning practices of people with ND concerns achieving a long-term career goal based on the person's preferences, interests, and abilities (Stock, Davies, Secor, & Wehmeyer, 2003). Making choices and identifying one's preferences are fundamental features of self-determination, understood as those "vocational actions that enable a person to act as the primary causal agent in his or her life and to maintain or improve his or her quality of life" (Wehmeyer, 2005). Many people with ND often have limited experiences on which to develop preferences, especially about work. This limitation is often exacerbated by communication difficulties and the fact that these people often need the support of others to fit into community and work environments (Stock et al., 2003). As a result, many people with ND cannot express their job preferences and do not achieve self-determination.

Job matching is a process that involves identifying an individual's strengths, which make success in a particular job likely, weaknesses, which may compromise it, and methods to overcome these weaknesses (Morgan, 2008).

According to some authors (Micheals, 1998; Rumrill & Roessler, 1999), this process would not only involve finding a compatible job in the short term, but a series of well-matched career opportunities based on a long-term plan. Therefore, when planning a university education, it seems essential to assist students with disabilities in linking their achievements to their subsequent career goals. Attempts to determine what factors can help people with disabilities retain a job reveal that a critical factor is interacting appropriately with colleagues, superiors, and others in the workplace (Clark, Konrad, & Test, 2018).

However, in a job matching process, it may be the case that there are not the necessary tools to ensure that preferences are the person's actual ones or that they are based on a wide range of experiences to form preferences. Therefore, such a process can produce matching based on factors external to the individual than on their actual interests (Morgan, 2011; Stock et al., 2003).

Similarly, soft skills (e.g., ability to work in a team, problem-solving, decision-making, communication, flexibility) are considered more important in the workplace than academic skills (Clark et al., 2018). Employers seem to value these non-specific skills more than technical skills (Ju, Zhang, & Pacha, 2012).

Given the lack of soft skills as one of the significant barriers to employment of people with disabilities, it seems necessary to take these skills into account when planning a career (Clark et al., 2018; Grob, Lerman, Langlinais, & Villante, 2019).

In the literature, few strategies are described for determining the preferences of people with ND regarding work and employment and assessing soft skills. One of the main problems of most instruments for assessing vocational interests is that they require a high level of cognitive functioning to be completed (Davies et al., 2018). Therefore, the usefulness of such tools for people with ND would seem to be limited.

Rationale and aim of the review

Vocational outcomes for people with ND are generally limited (Hume et al., 2018), especially when presenting behavioral problems and cognitive impairments. When planning a career path for people with ND, it is crucial to consider that employability depends on a person's knowledge, skills, and attitudes he or she possesses, perception of his or her abilities, as well as the way he or she uses those skills. Moreover, an adequate presentation of oneself to employers and the match between personal preferences and the work environment within which the individual seeks employment are both of crucial importance (Gal et al., 2015). Therefore, employability may represent a big challenge for people with ND.

Based on these considerations, we used an exploratory approach to analyze the results of studies that used assessment tools and procedures to evaluate job preferences and interests, soft skills and job-relevant interpersonal skills, perceptual factors (i.e., perception of strengths and limitations, attitudes, personal competencies) job matching for young people and adults with ND. The present review aims to provide mental health professionals and educators with a comprehensive overview of assessment tools and their use in practice, to help young people and adults with ND plan their career paths.

Method

Inclusion and exclusion criteria

A systematic literature review was conducted using the criteria of the PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Page et al., 2021).

To be included in the review, articles had to meet the following criteria:

1) Year of publication: 2000 to 2020. This time range was selected to ensure the most current research analysis possible. Therefore, articles published outside this timeframe were excluded.

2) Characteristics of participants: young people and adults with neurodevelopmental disorders. Studies conducted solely with physical disabilities were excluded unless participants with mental disorders were included in the sample. About age, studies whose participants were aged 13 years and over were included. This age range was selected to overview assessment tools from a developmental perspective, covering adolescence and adulthood. Adolescence is a crucial period in which identity begins to be structured, and there is a more excellent definition of personal goals.

3) English language: only studies articles in English were included, thus excluding studies presented in a different language.

4) Article type and procedures: studies focusing on assessment tools and procedures to evaluate job preferences, soft skills and perceptual factors (i.e., perception of strengths and limitations, attitudes, personal competencies), and job matching were included. Studies were included with or without control groups. Studies that did not focus on assessment tools and procedures were excluded as well as systematic reviews and dissertations.

Search and selection of studies

We strictly followed PRISMA recommendations for systematic literature analysis have been strictly followed, to assess the risk of bias. The systematic search for studies was conducted by consulting the following databases: PsycInfo, Scopus, Web of Sciences, and Pub Med. The search strategy was developed using Boolean AND/OR operators within the following search string: "soft skills" OR "job preferences" OR "job interest" OR "job matching" AND "intellectual disability" OR "mental retardation" OR "learning disability" OR "developmental disability" or "autism" AND assessment OR evaluation.the last search was conducted in February 2021.

Table 1 shows an example of the search strategy used and the results for one of the databases. The search strategy described was also applied in all other databases.

Further literature was identified through a manual search, including Google Scholar and secondary sources (e.g., bibliographical references of the identified articles).

CODE	SEARCH STRING	RESULTS
S1	“Soft Skills”	237
S2	“Job Preferences"	50
S3	"Job Interest"	14
S4	“Job Matching"	39
S5	"Intellectual Disability"	13968
S6	“Mental Retardation”	17478
S7	“Learning Disability”	4086
S8	"Developmental Disability"	21107
S9	Autism	54566
S10	Assessment	332771
S11	Evaluation	212335
S12	S1 OR S2 OR S3 OR S4	338
S13	S5 OR S6 OR S7 OR S8 OR S9	78770
S14	S10 OR S11	480195
S15	**S12 AND S13 AND S14**	**9**

Table 1 - Articles search strategy used on PsycInfo and results

As shown in figure 1, 52 articles were identified through database consultation, while the manual search identified 18 articles, making 70 articles. Three researchers were independently responsible for data extraction and quality assessment of the articles. All discrepancies were resolved by agreement between the authors of this review. The next step was to eliminate ten duplicates by comparing titles and authors.

60 articles were screened for abstracts and study objectives. This step resulted in the exclusion of 26 articles. Precisely, titles and abstracts were screened by two researchers, who used the previously defined criteria to determine the eligibility of articles for inclusion in the review. The remaining 34 articles were examined in detail through a full-text analysis. Of the articles reviewed, 22 were considered suitable for inclusion in the review, while 11 articles were removed for unrelated topics based on the exclusion criteria identified above.

In total, the following review presents a comparison of 22 research articles.

Characteristics of selected studies

Overall, the following review presents a comparison of 22 research articles with different experimental designs. The sample size in the different studies ranged from three to 539.

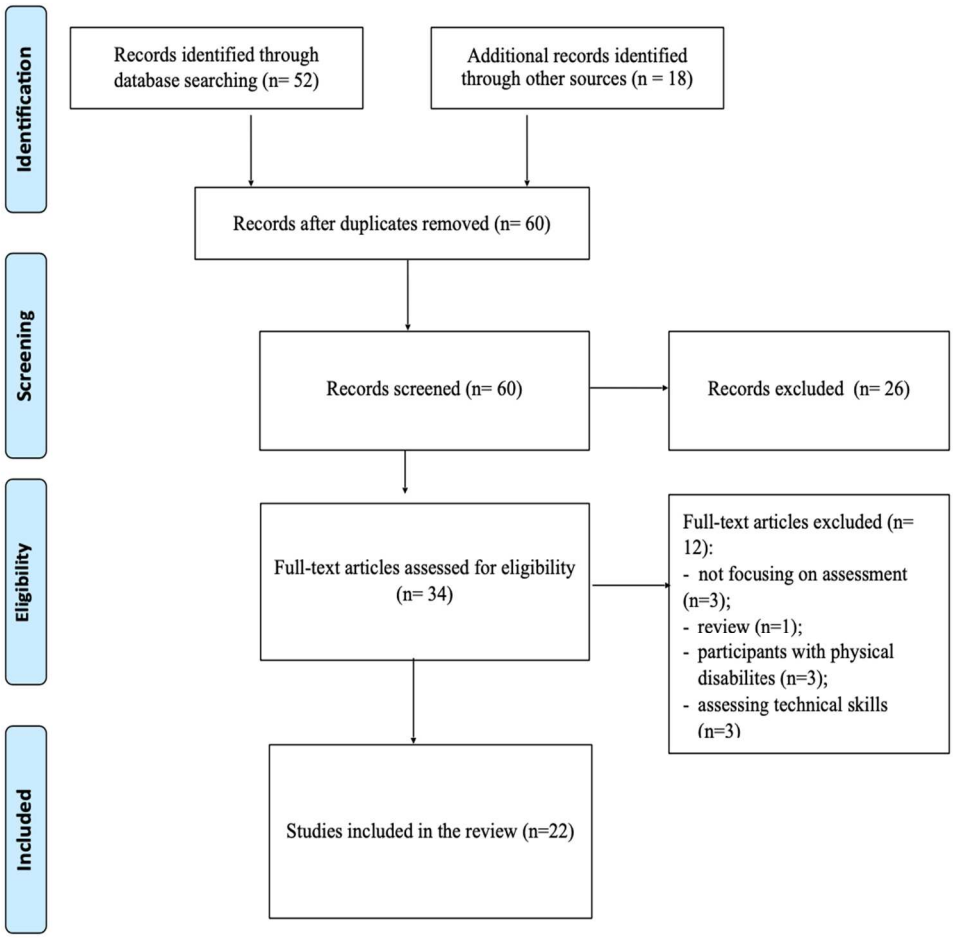

Figure 1- Flow diagram describing the articles selection steps

13 articles reported samples with fewer than 15 participants (range, 3-14): Clark et al., 2018; Grob et al., 2019; Hall et al., 2014; Horrocks & Morgan, 2009; LaRue, Maraventano, Budge & Frischmann, 2019; Lattimore, Parsons, & Reid, 2002; Lattimore, Parsons & Reid, 2003; Lerman, White, Grob and Laudont, 2017; Morgan & Horrocks, 2011; Reid et al., 2007; Roessler, Hennessey & Hogan, 2009; Stock et al., 2003; Walsh, Lydon & Holloway, 2019.

Five articles had a sample size between 18 and 46 participants (Davies et al., 2018; Ellerd, Morgan, & Salzberg, 2006; Gal, Meir, & Katz, 2013; Morgan, 2008; Morgan, 2011).

Only four studies had a sample size of more than 100 participants. Specifically, in Gal, Landes, and Katz (2015), there were 139 participants.

In Hume et al. (2017), there were 539 participants; in Mattie (2000), there were 337, and in Dipeolu, Hargrave, Sniatecki, and Donaldson (2012), the sample size was 139 participants. Table 2 reported the data of each article, and it describes the main characteristics and results of the selected studies.

AUTHORS AND YEAR	PARTICIPANTS	ASSESSMENT TOOL	METHOD (OBJECTIVE/EXPERIMENTAL DESIGN/ANALYSIS)	RESULTS
Grob et al., 2019	3 unemployed adults, recruited through a vocational rehabilitation agency Gender: 1 F and 2 M. Age: 19-27. Diagnosis: Autism Spectrum Disorder or PPD-NOS	Assessment of job-related social skills	- During work sessions of 10-15 minutes in which activities such as folding and hanging shirts, stocking items on shelves, filing paper, folding letters and putting them in envelopes, creating presentations with Microsoft PowerPoint, entering data or creating charts with Microsoft Excel are carried out. The following variables are measured: affirmation statements, requests for help, responses to corrective feedback.	The proposed assessment was effective in assessing positive comments, requests for help and responses to corrective feedback. However, future research should evaluate the social validity of some responses, such as positive statements in response to instructions and apologizing when receiving corrective feedback.
LaRue et al., 2019	6 adults in a rehabilitation centre Gender: 6 M. Age: 21-41. Diagnosis: Autism spectrum disorder	Vocational preference assessment	- Assessment of client choice for specifical skills: preference for social interaction, preference for complex or repetitive tasks, and preference for sedentary or mobile tasks. - Matched and unmatched job experiences and monitoring work productivity and disruptive behavior. Vocational preference assessment to determine preferred jobs	When participants were given a choice between matched and unmatched jobs, they always chose to complete the jobs that matched their profile results. A brief competency-based vocational assessment can be a valuable tool for improving the employment outcomes of adolescents and adults with autism.
Walsh et al., 2019	3 young adults in a vocational rehabilitation centre. Gender: 1 F and 2 M. Age: 20-21. Diagnosis: autism spectrum disorder and intellectual disabilityound intellectual disability	Job preference assessment and job matching	To evaluate the effects of a technology-based prework assessment on job performance. Three job conditions were established: a high-preference, high-skill-match job; a high-preference, low-skill-match job; and a low-preference, low-skill-match job. The 3 job conditions were evaluated using an alternating-treatments design with supported-employment sessions counterbalanced across a 6-week period.	Effective procedure in assessing the work preferences of all three participants. When participants were given a choice and asked to choose the job they liked best at the end of each week, each participant chose the job that the pre-work preference assessment had indicated was highly preferred more freely than the least preferred job. Job preference and choice can have a potential impact on performance within the work context. All three participants scored higher on high-preference job conditions than on low-preference job conditions.
Clark et al., 2018	4 high school students. Gender: 3 F and 1 M. Age: 14-16. Diagnosis: 2 with mild intellectual disability and 2 with hearing impairment	Job performance rubric	Single-subject multiple probes across participants design. to investigate the effects of a soft skills training on the acquisition of soft skills of students with disabilities	The tool is useful for monitoring students' progress during the job placement process.
Davies et al., 2018	20 adults Gender: 12 F and 8 M. Age: 20-60; Diagnosis: Intellectual disability	MyJobQuest System	Chi square analysis: To establish the technical merit and functional features of MyJobQuest System and provide preliminary analysis of the effectiveness of MJQ for enabling people with intellectual disability to communicate job preferences.	People with intellectual disabilities can reliably assess vocational interest when they receive cognitively accessible technological support. They can identify areas of vocational interest that are consistent with those identified by professionals familiar with the person.
Hume et al., 2018	539 high school students. Gender: 75 F and 464 M. Age: 13-22. Diagnosis: Autism Spectrum Disorder	SSSC (Secondary School Success Checklist)	To determine the level of transition-related skills of adolescents with ASD as reported by the adolescents, their parents, and their teachers. Second, to describe the perceived importance of each skill across informant groups. Third to examine the relationships between the perceptions of skill proficiences across informant groups.	Results indicate discrepancies between adolescents', teachers', and parents' assessments of skills, highlighting the importance of including multiple perspectives in transition planning. Although ratings differ, the agreement among adolescents with autism spectrum disorder, parents, and teachers on the highest and lowest skills suggests the need to expand the focus on critical transition skills to include problem solving, planning for life after high school, and self-advocacy.

AUTHORS AND YEAR	PARTICIPANTS	ASSESSMENT TOOL	METHOD (OBJECTIVE/EXPERIMENTAL DESIGN/ANALYSIS)	RESULTS
Lerman et al., 2017	8 young people and adults unemployed. Gender: 1 F and 7 M. Age: 16-32. Diagnosis: Autism Spectrum Disorder, Intellectual Disability, ADHD, speech disorder (some in comorbidity)	Job-related social skills in a clinical setting	To evaluate the effectiveness of an assessment of job-related social skills for individuals with ASD by arranging conditions that simulated on-the-job experiences in a clinic setting. The experimenter contrived situations to assess a variety of social skills, including asking for help, asking for more materials, and responding to corrective feedback.	The assessment was useful in identifying specific social skills that could be targeted for intervention to increase success in the work environment.
Gal et al., 2015	139 adults Gender: control group 25 F and 77 M; participants with autism 7 F and 30 M. Age: 20-40. Diagnosis: Autism spectrum disorder. Participants attended a rehabilitation course in a specialized center	Autism Work Skills Questionnaire (AWSQ)	To examine the discriminate validity of AWSQ between people with high functioning autism to controls with typical development.	Significant differences were found in almost all domains of the questionnaire. Significant correlations between the different categories among people with typical development as opposed to a small number of correlations found among people with autism. The results underline a unique work profile of adults with autism and highlight the importance of assessing these skills to help them find a job that matches their interests and work profiles.
Hall et al., 2014	4 young adults in a post-high school transition program. Gender: 2 F and 2 M. Age: 19-20. Diagnosis: mild to moderate intellectual disability.	Web-based job preferences and job matching assessment	Job preference: participants watched selected videos of jobs, followed by instructions from a narrator "choose the job you want!", then selected an icon to indicate their preference. The participant reduced the list of high preference jobs to 3, after which selected the preferred activities for each job on the site. Then the assessment was repeated to determine the low-preference jobs, using the same procedure. Job matching: job coaches rated the participants' skills as poor, acceptable and good on each of the 106 dimensions assessed. These included judgment and decision making, critical thinking, money skills, reading comprehension. A proportion score of 0 to 1 was calculated to indicate the degree of job-matching for each of the 3 high and low preference jobs. A higher score indicated a better match.	Jobs with high preference and matching are associated with higher performance and satisfaction. The proposed assessment is a useful tool for predicting the degree of matching between skills and job requirements. The combination of high preference and high matching would appear to more strongly predict labour productivity.
Gal et al., 2013	46 adults in transition from an educational to a working context or employed in the past and looking for work. Gender: 10 F and 36 M. Age:18-39. Diagnosis: high-functioning autism spectrum disorder	Autism Work Skills Questionnaire (AWSQ)	Two-phase study: 1) constructing the questionnaire and determining its content validity. Ascertaining internal consistency reliability	The AWSQ is a clinical and research tool useful in occupational therapy for assessing the work skills of adults with high-functioning autism.
Dipeolu et al., 2012	139 high school students. Gender: 39 F and 100 M. Age:14-20; Diagnosis: learning disabilities	CTI, CMI-R, MSV-VI	To determine the predictability of critical career-related constructs using the CTI from measures of career maturity and vocational maturity and vocational identity in a normative sample of students with LDs; explore the relationship between the norms in the instruments' manuals and norms derived from a sample of students with LDs to determine the most usable data with this population	It is possible to foresee important career development for students with learning disabilities using standardized tools, which can guide subsequent interventions.

AUTHORS AND YEAR	PARTICIPANTS	ASSESSMENT TOOL	METHOD (OBJECTIVE/EXPERIMENTAL DESIGN/ANALYSIS)	RESULTS
Morgan, 2011	21 young adults attending post-high school transitional programs. Gender: not specified. Age: average age 19 years and 8 months. Diagnosis: intellectual disability	Job matching assessment	To assess the inter-reliability of a job matching tool designed for young adults with disabilities.	The results of this study provided data on the inter-rater reliability of a job matching assessment. The data indicated relatively high inter-rater agreement and low differences in index scores. However, across job dimensions, the data indicated high variability, with disagreement evident, for certain jobs (e.g., English language proficiency, safety awareness skills).
Morgan & Horrocks, 2011	3 young adults attending post-high school transitional programs. Gender: 1 F and 2 M; Age: 18-19. Diagnosis: intellectual disability	Video-based job preference assessment	The study started with a preference assessment conducted by video. The participants then performed high and low preference work tasks in community settings. The study concluded with a short interview of each participant. All sessions were conducted with individual participants.	Jobs identified with high and low preference in a video assessment were generally associated with high and low job performance respectively. Job performance in relation to preference varied between participants.
Horrocks & Morgan, 2009	3 young adults involved in a post-high school vocational training program. Gender: 2 F and 1 M. Age: 19-21. Diagnosis: Moderate to severe intellectual disability.	Video-based assessment and a multiple stimulus assessment	To compare 2 methods of assessing job preferences, one in which the participant has access to the stimuli after selecting, and one in which the participant does not have access to stimuli after making a preference selection.	Both procedures identified the same job as the highest preference for all participants.
Roessler et al., 2009	4 university students. Gender: 3 F and 1 M. Age: 21-50. Diagnosis: ADHD and schizotypal personality disorder, dyslexia and partial vision loss, depression, multiple sclerosis	SDS, WES, PCQ	4 Case Studies involving students with disabilities. The career assessment includes reliable and valid measures of vocational interests, barriers to productivity, strenghts, and disability-related limitations.	By combining measures of career interest, productivity barriers, personal strengths and disability-related limitations with information from job analysis, career specialists can engage post-high school students with disabilities in a careful and comprehensive assessment of their needs as they transition from high school to career.
Morgan, 2008	18 young people and adults who are high school students or attending post-high school transitional programs. Gender: 8 F and 10 M. Age: 17-21; Diagnosis: neurodevelopmental disorders	Job preference assessment and job matching	The article describes a job preference assessment, one method for assessing degree of match across preferred jobs, and initial field evaluation	Assessment useful in assessing the degree of job matching.
Reid et al., 2007	12 part-time employees. Gender: not specified. Age: 29-76. Diagnosis: severe or profound intellectual disability	Multipli-stimuli job preferences assessment and assessment between pairs of job activities.	To evaluate a protocol for identifying work preferences among adults with severe disabilities in supported jobs. The protocol involved obtaining opinions of support staff regarding most and least preferred tasks of a support worker, conducting a multi-task preference assessment and then, if necessary, a paired-task assessment for workers for whom the former assessment did not reveal job preferences.	For the 12 participating workers, the multi-activity evaluation revealed preferences for 7 of the workers and subsequently, the pairwise evaluation revealed preferences for 4 of the remaining 5 workers. The first evaluation took 40% less time than the second one.
Ellerd et al., 2006	20 unemployed young adults with work experience of less than 1 year. Gender: 10 F and 10 M. Age: 18-22. Diagnosis: Intellectual disability	Video CD-ROM assessment, observation in the actual context, choice between pairs of pictures	To examine the criterion validity of a video CD-ROM job preference program by assessing correspondence of participants choices across video, pictures and community-based job observations	34 of the 40 preferred jobs on the video CD-ROM program were identified as preferred after community observations, and 33 of the 40 preferred jobs on the video CD-ROM program were identified as preferred by photographs. Twenty of the 40 non-selected jobs were identified as preferred after community visits.

AUTHORS AND YEAR	PARTICIPANTS	ASSESSMENT TOOL	METHOD (OBJECTIVE/EXPERIMENTAL DESIGN/ANALYSIS)	RESULTS
Lattimore et al., 2003	5 adults employed part-time. Gender: 5 M. Age: 26-38. Diagnosis: Autism Spectrum Disorder, Severe or profound intellectual disability, X-Fragile Syndrome. None communicated vocally; all had stereotypes and histories of problem behaviors	Pre-work preference assessment and job preference assessment on the job site	To evaluate a multiple stimulus assessment for predicting on-the-job preferences among adults with autism who were about to begin new, community job tasks. Another aim was to evaluate the multiple-stimulus assessment for predicting preferences to alternate tasks versus working on one task during the daily job routine.	Predictive assessment of what workers with autism preferred to work on during the regular work routine. Usefulness was most apparent when workers showed a strong task preference on the pre-work assessment. When adults with autism show a strong preference for a particular work task on the multiple-stimulus pre-work assessment, assigning that task during the subsequent work routine is likely to represent a work activity that workers find preferable.
Stock et al., 2003	14 adults receiving services from a job centre. Gender: not specified. Age: 18+ years. Diagnosis: intellectual disability	Work Sight System	Preliminary study to investigate the application of a self-directed video and audio software program to assist individuals with intellectual disabilities to express their vocational job preferences. The effectiveness of WorkSight was tested by comparing it to currently used career assessment instruments via ratings by educators and agency professionals.	The integrated multimedia system offered by the WorkSight system led to an informative and cost-effective way of determining participants' professional interests. These results must be considered preliminary, however, as the scope of research and time available for evaluation was limited.
Lattimore et al., 2002	3 adults employed part-time. Gender: 3 M. Age: 25-29. Diagnosis: Autism spectrum disorder, severe or profound intellectual disability, none communicated vocally	Pre-work preference assessment and job preference assessment on the job site	A prework paired-task assessment was evaluated for identifying work preferences among 3 adults with autism beginning a supported job. When the workers began the job, choices were provided between more and less preferred tasks (determined by previous assessment).	The procedures were useful in identifying preferences for an individual task.
Mattie, 2000	337 students. Gender: 118 F and 219 M. Age: 13-21. Diagnosis: learning disabilities or mild intellectual disabilities (some able to read others not)	Self-Directed Search (SDS)	To examine the validity of SDS vocational assessment instrument when used with non-readers with learning disabilities or mild mental retardation.	SDS is a valid instrument, suitable even for non-readers with learning disabilities or mild intellectual disabilities. In general, when teachers followed the prescribed SDS test administration procedures for their non-reading students, the students made test choices that were as reliable and varied as the choices of the populations for which the instrument was intended. In addition, the instrument was sensitive to disability and gender differences in the sample groups examined

Table 2. Summary of studies ccharacteristics and results

Concerning demographic characteristics, all studies reported the mean age of the participants, which ranged from 13 to 76 years. The total number of male participants (N=986) was greater than that of female participants (N=318). Only in three studies (Morgan, 2011; Reid et al., 2007; Stock et al., 2003) was the gender of participants not specified.

In the selected studies, the diagnoses of participants with ND were mainly autism spectrum disorder, mild to profound Intellectual Disability, ADHD (Attention Deficit Hyperactivity Disorder), often present in comorbidity with each other, or other disorders.

In eight studies (Clark et al., 2018; Hall et al., 2014; Horrocks & Morgan, 2009; Morgan, 2008; Morgan, 2011; Morgan & Horrocks, 2011; Roessler et al., 2009; Stock et al., 2003), participants were placed in post-high school transition programs or vocational courses, in three studies (Lattimore et al., 2003; Lattimore et al., 2003; Reid et al., 2007) they were employed on part-time shifts in supported jobs. Still, others were volunteer participants (Davies et al., 2018) or unemployed people with work experience of less than one year or attending vocational rehabilitation centers (Ellerd et al., 2006; Gal et al., 2013; Gal et al., 2015; Grob et al., 2019; LaRue et al., 2019; Lerman et al., 2017; Walsh et al., 2019). In three studies (Dipeolu et al., 2012; Hume et al., 2017; Mattie, 2000), participants were high school students.

The studies selected for this review were mainly conducted in the USA (N=19); two studies only were conducted in Israel (Gal et al., 2013; Gal et al., 2015) and another in Ireland (Walsh et al., 2019).

Analysis of assessment tools

Table 3 summarizes the characteristics of the assessment tools used in the studies included in the review. Most of the preference assessment and job matching strategies were implemented by employment counselors, rehabilitation professionals, or teachers.

Data synthesis and analysis

We used an exploratory approach to evaluate methodological issues and interpret all results to synthesize the main results. Based on our review objective, we grouped the studies in four assessment areas: a) work preferences and interests; b) self-assessment instruments for perceptual factors and job preferences; c) soft skills and social work skills; d) job matching.

Area of investigation	Assessment tool	Description	Articles included in the review
Job preferences	MyJobQuest System	Interactive tablet app that presents career choices to people through an interface that does not require reading skills or assistance from others to complete	Davies et al., 2018
	Vocational assessment	3 evaluations: - Interaction: choice between interacting with a new staff member and sitting at a table alone. Monitoring of choices and amount of time. - Complexity: choice between a chained task and a simple, repetitive task. Monitoring of choices and amount of time. - Movement: choice between a task that required walking and a task that required sitting. A profile of the worker was then drawn up based on the amount of time allocated to the different assessment conditions.	LaRue et a., 2019
	Pre-work preference assessment	Work samples/examples; five items are presented to participant representing different domains of a job. Participant chooses preferred task. Participant then performs job for three minutes and the process is repeated. The frequency of selected job tasks is measured.	Lattimore et al., 2002; Lattimore et al., 2003; Reid et al., 2007
	Video-based assessment	To choose between pairs of videos of different jobs to create a hierarchy of preferences. A selection percentage score was calculated for each job by dividing the number of times the job was selected by the number of times it was available for selection and multiplying by 100. The jobs were then ranked as most and least preferred based on this selection percentage. (The number of videos presented to participants changed between studies)	Ellerd et al., 2006; Hall et al., 2014; Horrocks & Morgan, 2009; Morgan 2008; Morgan, 2011; Morgan & Horrocks, 2011; Stock et al., 2003; Walsh et al., 2019
	Assessment between pairs of job activities	Once a task was chosen, the participant worked on the task for a period of 3 minutes. Then a second trial was conducted, giving the participant a choice in which the previously selected task was matched to one of the remaining tasks. Each task was chosen when paired with another task for an assessment session, and then the percentages for each task were averaged across all sessions. Assessment sessions continued until a task met the preference criterion (with a minimum of three assessment sessions), or when five sessions were completed, and no task met the preference criterion.	Reid et al., 2007
	Self-Directed-Search (SDS)	Questionnaire; to assess an individual's preferences among realistic, investigative, artistic, social, entrepreneurial and conventional occupations. It is a self-administered, self- marked and self-interpreted assessment.	Mattie, 2000; Roessler et al., 2009
Perceptual factors	Career Thoughts Inventory (CTI)	Questionnaire: 48 items; the total score is considered a single global indicator of dysfunctional or negative career thoughts; 3 areas of dysfunctional thinking: (a) decision confusion (b) commitment anxiety; and (c) external conflict, respondents may show dysfunctional thinking within a specific area or in several areas simultaneously; scored on a four-point Likert scale (strongly disagree = 1 to strongly agree = 4).	Dipeolu et al., 2012
	Career Maturity Inventory-Revised (CMI-R)	Questionnaire: 50 items; two subscales (i.e.., attitude scale and competency test); both scales are 25 questions.	Dipeolu et al., 2012
	My Vocational Situation-Vocational Identity (MSV-VI)	Questionnaire: Composed of 18 true/false items. The score for scale VI is obtained by counting the total number of false answers. A high score indicates a relatively strong professional identity, while a low score represents an unstable sense of professional identity.	Dipeolu et al., 2012
	Work Experience Survey (WES)	Structured interview protocol; six sections: background information, barriers to physical access in the workplace, problems with essential job functions, job mastery concerns, job satisfaction, and accommodation planning priorities.	Roessler et al., 2009
	Personal Capacities Questionnaire (PCQ)	Questionnaire: self-report; to measure an individual's strengths and limitations in terms of employment. The results indicate the extent to which the person believes he or she has disability-related abilities or limitations in areas such as vision, mobility, judgment, finances, acceptability to employers, and skills.	Roessler et al., 2009

Area of investigation	Assessment tool	Description	Articles included in the review
	Autism Work Skill Questionnaire (AWSQ)	Questionnaire: semi-structured; 78 items divided into 9 subscales that evaluates personal aspects and the individual's educational background, work history, work habits, independence, strengths and weaknesses in the work environment, preferred social and physical environment, daily activities, interpersonal skills and future goals; participant's rate response on 5-point Likert scale (1 very low to 5 very high)	Gal et al., 2013; Gal et al., 2015
	Secondary School Success Checklist (SSSC)	Questionnaire: for adolescents: 20 items for 4 domains; scored on a 3-point Likert scale (very like me =2, more or less like me =1, or not like me=0). Then adolescent provide a priority ranking for the importance of learning each skill. For parents and teachers: 105 items for 4 domains. It is divided into sub-domains. For each item, scored on a 3-point Likert scale (very similar to my student/child =2, more or less like my student/child=1, or not like my student/child =0) Respondents can also choose a "Not observed" or "Not applicable" response. A priority ranking is then requested only for skills classified as 0 (not like) or 1 (more or less like)	Hume et al., 2018
Soft skills	Job performance rubric		Clark et al., 2018
	Assessment of job-related social skills	During work sessions of 10-15 minutes in which activities such as folding and hanging shirts, stocking items on shelves, filing paper, folding letters and putting them in envelopes, creating presentations with Microsoft PowerPoint, entering data or creating charts with Microsoft Excel are carried out. The following variables are measured: affirmation statements, requests for help, and responses to corrective feedback. The same variables were measured by Lerman et al. (2017) in a clinical setting	Grob et al., 2019; Lerman et al., 2017
Job matching	Job matching assessment	Morgan, 2008, 2011: Facilitator assigned weighting to 106 dimensions. Job match is computed from the weightings assigned to the job dimension and preference choice by participant. Walsh et al., 2019: The percentage of tasks completed was calculated by recording each correctly performed step and dividing the correct number of steps by the total number of steps in the task analysis and multiplying by 100. A higher score represented a better skill match.	Morgan,2008; Morgan,2011; Walsh et al., 2019

Results

Job preferences and interests

In general, the assessment strategies used in the different studies seem to be effective in assessing the work preferences of young people and adults with ND.

A multi-activity pre-work assessment seems to predict the subsequent preferences of workers with autism during the regular work routine when it identifies strong preferences (Lattimore et al., 2002; Lattimore et al., 2003; Reid et al., 2007). In cases where the pre-work assessment identifies weak preferences, the procedure nevertheless seems helpful in predicting preferences for alternative activities (Lattimore et al., 2003). Reid et al. (2007) identified the preferred and non-preferred jobs of 92% of the assisted workers through the preference assessment protocol. A systematically assessed preference was identified for 40 percent of the participants using staff assessments, 58 percent using a multi-task assessment, and 80 percent using a task-pair assessment. The latter two percentages refer only to workers who participated in the respective types of assessment. The multi-activity assessment was conducted with all 12 participants, and

then the assessment with task pairs was carried out with the five workers for whom the previous assessment had not led to the identification of a preference for at least one job task.

Positive results also emerge from studies that have used computer programs or apps to assess the work preferences of young people and adults with ND (Davies et al., 2018; Ellerd et al., 2006; Hall et al., 2014; Horrocks & Morgan, 2009; Morgan, 2008; Morgan & Horrocks, 2011; Stock et al., 2003; LaRue et al., 2019; Walsh et al., 2019).

Findings from some studies (Davies et al., 2018; Walsh et al., 2019) show that even people with severe intellectual disabilities can independently express their work preferences when receiving cognitively accessible technological support (i.e., a tablet application).

Moreover, their interests appear to be consistent with those identified by professionals familiar with the person. Ellerd et al. (2006) assessed the work preferences of 20 young adults with ND through a CD-ROM assessment program, an observation of community work in work contexts, and photographs of the latter. Some of the selected work settings were chosen as highly preferred through the CD-ROM program, while others were those not chosen. The results indicate that most of the preferred jobs on the video were identified as preferred following observation in the natural context and from the photographs. Half of the unselected jobs were identified as favorites following visits to the workplace. These data seem to support using the CD-ROM program with people with ND because the job preferences expressed on the video seem to correspond relatively highly to the job choices in the actual context. Horrocks and Morgan (2009) compared two methodologies for identifying the work preferences of three young people with severe intellectual disabilities. The first methodology consisted of a video assessment, while the second consisted of choosing a preferred job, following short work sessions with the material needed to perform the task. Both procedures proved effective in identifying the same top-preferred jobs for all participants.

In addition, concerning computer-based procedures, Morgan and Horrocks (2011) evaluated the correspondence between a preference assessment procedure on video and subsequent work performance in a work context. The authors found that participants worked more when engaged in high preference tasks. They usually selected high-preference jobs when they were allowed to choose which activity to do. The results are consistent with the preferences expressed through the video-based assessment. Similar results can be found in LaRue et al. (2019) and Walsh et al. (2019).

Self-assessment tools for perceptual factors and job preferences

SDS is a reliable and valid instrument for self-assessment preferences, even for people with learning disabilities or mild intellectual disabilities. In Mattie's study (2000), when teachers administered the test to their students, who could not read, they could make reliable choices. The SDS was also used in the study by Roessler et al. (2009) and the WES and PCQ.

A comprehensive assessment using multiple instruments can be helpful for professionals to engage students with disabilities in a careful and comprehensive assessment of their needs as they transition from higher education to the profession.

Among the assessment tools, the AWSQ (Gal et al., 2013; Gal et al., 2015) is a questionnaire that can inform professionals about problems in vocational settings that people with autism may experience in different work domains (e.g., work habits, interpersonal skills, autonomy at work and study). The questionnaire makes it possible to create a job profile and assist the person in entering a work context suited to his/her skills. In the study by Hume et al. (2017), the administration of the SSSC showed that adolescents perceived themselves as more competent than the assessment given by parents and teachers. Despite this, there was a degree of agreement on competencies assessed as higher and lower in the three groups.

In the design of work pathways of students with learning disabilities, standardized instruments (i.e., CMI-R; MVS-VI; CTI) can also be used, which allow for the prediction of essential constructs (Dipeolu et al., 2012).

Soft skills and social and interpersonal skills in the working environment

The study by Clark et al. (2018) aimed to evaluate the effects of a teaching program (i.e., UPGRADE Your Performance) on the acquisition of soft skills (e.g., attitude, cooperation, reliability, productivity, on-task behavior, quality of work, teamwork) of high school students with disabilities. The results show that the JPR, used as a soft skills assessment tool, is also helpful in monitoring students' progress during their vocational integration program.

In addition, in the same area, the work-related social skills assessment proposed by Grob et al. (2019) effectively assessed positive comments, requests for help, and responses to corrective feedback. However, future research should assess the social validity of some responses, such as positive statements in response to instructions and apologizing when receiving corrective feedback.

Lerman et al. (2017) also demonstrate the effectiveness of an objective methodology for assessing a range of social skills (i.e., requests for help, requests for materials, and responses to corrective feedback) in controlled naturalistic settings.

In general, all soft skills and other social skills assessment procedures appear to help identify specific skills targeted for intervention to increase people's success with ND in a work setting.

Job matching

Job matching is the first step in successful job placement for people with ND (Morgan, 2008; Morgan, 2011; Hall et al., 2014). Indeed, data from this process can be the starting point for further interventions and subsequent professional development (Morgan, 2008). In Morgan's (2011) study, after assessing the work preferences of 21 young adults with intellectual disabilities, five pairs of observers were asked to complete a job matching assessment to identify the job that best matched the participant's current characteristics. Results indicated very high inter-assessor agreement.

Hall et al. (2014) investigated whether job preference and degree of matching were associated with higher job performance and satisfaction. The results indicate that jobs with higher preference and correspondence were associated with higher productivity, accuracy, and satisfaction, almost in all cases. LaRue et al. (2019) also found that all participants worked better when holding jobs that matched the assessment results. Moreover, when given a choice between jobs that matched and did not match their profile, participants always selected jobs that matched their skills. Thus, a computer-based assessment procedure that includes a job-matching component would appear to be able to predict, to a reasonable extent, the match between skills and job demands (Hall et al., 2014).

Discussion

This review examined scientific contributions describing procedures and tools for assessing work preferences and interests and job matching, soft skills, and social skills relevant to the job for young people and adults with ND, as well as perceptual factors relevant to employability (e.g., limitation and strengths, personal competences, attitudes).

The results highlight that job preference assessment can be a valuable strategy for identifying the interests of this population (Davies et al., 2018; Ellerd et al., 2006; Hall et al., 2014; LaRue et al., 2019; Morgan, 2008; Morgan & Horrocks, 2011; Stock et al., 2003) even in the case of adults with severe disabilities (Horrocks & Morgan, 2009; Lattimore et al., 2003; Reid et al., 2007; Walsh et al., 2019).

When adults with ND show a strong preference for a task assigned in a pre-work assessment among multiple tasks, the assignment of that task in the subsequent work routine will most likely represent a work activity that the worker will prefer (Lattimore et al., 2002; Lattimore et al., 2003).

Another way to enable workers with ND to perform preferred work activities would be to provide frequent choices in the workplace. However, the nature of the work and the day-to-day needs of companies do not always allow frequent choices (Lattimore et al., 2003). When some flexibility is

possible for different tasks to be performed, job tasks could be assigned according to individual preferences. In this sense, some workers might engage in strongly preferred activities over others to alternate in non-preferred activities (Lattimore et al., 2003).

An important aspect that emerges from the analysis of studies is the impact of choice on performance within work contexts (Morgan & Horrocks, 2011; Walsh et al., 2019). For this reason, accurate preference assessment can help employers tailor employment based on workers' preferences rather than trying to make them fit into jobs with inflexible responsibilities (LaRue et al., 2019). This procedure could provide more job opportunities for people with ND, improve their job performance and potentially lead to a more positive work experience.

Measuring the work preferences of people with ND appears to be more reliable when they can express their choice personally. Technology appears to facilitate the assessment of work preferences, even those with severe disabilities (Davies et al., 2018; Stock and Davies, 2003; Walsh et al., 2019). Most computer-based or app-based assessment procedures ensured that participants could independently watch videos of different work activities and select their preferred one (Davies et al., 2018; Hall et al., 2014; Stock and Davies, 2003). This outcome is essential in terms of self-determination (Wehmeyer, 2005), considering that people do not have to receive training to use such programs and issue very few calls for help (Davies et al., 2018; Stock and Davies, 2003). Computer programs can provide people with ND with more information about a specific job, guiding them towards a more informed choice. Indeed, it is often difficult for these people to conceptualize what a job might be. Future research could develop videos that represent a job category, thus reducing the need to imagine what a job would look like or what activities should be performed. Technology also appears to have a substantial impact on the motivation of people with ASD and reduces the time required for professionals to assess vocational interests (Horrocks & Morgan, 2009; Stock et al., 2003).

Concerning young people with learning disabilities or autism spectrum disorder, the literature highlights the importance of vocational skills self-assessment questionnaires (Dipeolu et al., 2012; Gal et al., 2013; Gal et al., 2015). These instruments are helpful in the work placement phase because they provide additional information to that reported by parents or other reference figures. Indeed, when adolescents with ND assess their current level of skills, their perceptions are often very different from those of parents and teachers (Hume et al., 2017). Questionnaires to investigate work preferences (Dipeolu et al., 2012; Mattie, 2000; Roessler et al., 2009) may also be helpful for people with ND to assess their needs in the critical transition from higher education to work.

Overall, this review shows that self-assessment tools help young people with ND develop a sense of self-efficacy about their abilities to seek and keep a job.

Job matching assessment can be another valuable tool in the career planning of young people and adults with ND, as it can predict the degree to which skills and preferences match job demands (Hall et al., 2014; LaRue et al., 2019; Morgan, 2011; Morgan & Horrocks, 2011). Studies indicate that jobs with high preference and skill matching are associated with higher job performance, productivity, satisfaction, and accuracy in performing tasks (Hall et al., 2014; Morgan & Horrocks, 2011). This methodology is essential, especially for people with ND, as they have very different abilities, so the degree of matching between different jobs is likely to change (Morgan, 2011). Wrong matches may decrease the person's motivation to work and the employer for hiring staff with ND.

While it may seem logical that an individual's preference for a job increases the likelihood of success, preference does not seem sufficient (Hall et al., 2014). In other words, a person might show a strong preference for a job but lack the necessary skills to perform it. Therefore, a job preference assessment and a job matching procedure could help identify which skills to teach (Ellerd et al., 2006).

A further aspect to consider is job-related soft skills when planning a career for young people and adults with ND.

The literature review shows that there are no specific tools for assesing these skills in young adults with ND. Despite this, the assessment tools and procedures used (e.g., Job Performance Rubric) in the studies included in this review (Clark et al., 2018; Grob et al., 2019; Lerman et al., 2017) represent the first attempt towards this direction. These instruments were primarily created to assess changes in soft skills following the introduction of behavioral intervention programs specific to these skills (Clark et al., 2018; Grob et al., 2019). In contrast, Lerman et al. (2017) describe an assessment that can also be used in more clinical settings, which helps identify the difficulties of individuals with ND who have difficulty finding and maintaining employment. In general, studies show the importance of social, interpersonal skills, especially those involving interactions with supervisors and colleagues, in maintaining employment.

Conclusion

In conclusion, the literature review shows that the compatibility between the individual's interests and the job activities is highly correlated with the likelihood that the person will be satisfied with their position. A pre-employment comprehensive assessment can help the future ND worker understand the demands and activities of different jobs and how his/her characteristics will influence his/her career outcomes. At the same time, this process helps career planning professionals to create a work context that is as well adapted as possible to the personal characteristics of individuals with ND. This review highlighted no pre-employment assessment procedures for individuals with ND that are

strongly scientifically validated to date. However, the studies represent an attempt in this direction. An assessment that includes self-report tools and computer-based procedures for assessing work preferences, job matching, and soft skills could help people with ND develop a sense of self-efficacy about their abilities. This process may make it easier to find and keep a job.

Limitations and implications for professional practice

The main limitation of the studies included in this review was the size of the samples, which included few participants (Clark et al., 2018; Davies et al., 2018; Ellerd et al., 2006; Gal et al., 2013; Gal et al., 2015; Grob et al., 2018; Hall et al., 2014; Horrocks & Morgan, 2009; LaRue et al., 2019; Lattimore et al., 2002; Lattimore et al., 2003; Lerman et al., 2017; Morgan, 2008; Morgan & Horrocks, 2011, Reid et al., 2007; Roessler et al., 2009; Stock et al., 2003; Walsh et al., 2019), except three studies (Hume et al., 2017; Dipeolu et al., 2012; Mattie, 2000), and by the lack of a control group (Davies et al., 2018; Gal et al., 2013; Hume et al., 2017). This limitation would not allow for the generalization of results (Ellerd et al., 2006; Hall et al., 2014). In this regard, future research should include more participants with different language functioning and abilities (Horrocks & Morgan, 2009).

In studies that used computer-based preference assessments via video, one of the limitations was the small number of assessment sessions (Hall et al., 2014; Morgan & Horrocks, 2011). Furthermore, in some cases, the tasks performed during the assessment were not representative of the multiplicity of activities characteristic of real jobs (Reid et al., 2007; Stock et al., 2003; Walsh et al., 2019), and the assessment did not include an assessment of preferences in the actual work context (Horrocks & Morgan, 2009). Even when a work environment was recreated within clinical settings, as realistic as possible, participants knew they were being assessed, which could influence the assessment results (Lerman et al., 2017). Other limitations were related to the time of administration of the assessment. For example, in Reid et al. (2007), preferences were assessed when people had already obtained supported employment and concerning activities related to that specific job, not preferences between multiple jobs.

Future studies should increase the number of assessment sessions and create instruments that include a wider variety of tasks for each job condition to represent each job more realistically.

Although a video-based assessment may emphasize the importance of job preference, professionals accompanying young people and adults with ND in starting a career should not overlook essential variables such as speed and quality of job performance, pay, training and qualifications, hours required, and supervision (Ellerd, 2006).

Another aspect to consider is the transient nature of preference (Roessler et al., 2009; Walsh et al., 2019). Preference can change based on exposure, social interactions with others, and even the time

of day. Therefore, work preferences should be assessed several times to examine, for example, the effects that exposure to a work activity may have on this variable. Job matching assessments should also be done frequently to assess whether the satisfaction and performance of workers with ND remain high even after weeks or months in jobs identified as preferred and whether, for example, they offer more significant opportunities to receive a pay rise or take on an essential role in an organization (Hall et al., 2014; Morgan, 2008; Morgan & Horrocks, 2011). The effectiveness of an assessment should also be assessed in terms of how far it leads in the long term to better employment outcomes in community settings (LaRue et al., 2019). This review examined studies in which self-assessment preference tools were used. One of the limitations of these instruments is that they do not provide for direct observation of the skills reported by the person completing them (Gal et al., 2013; Gal et al., 2015; Hume et al., 2017).

Nevertheless, adding a self-report tool to the initial assessment seems crucial, especially for people with higher functioning and the information reported by a parent or other assessment procedures. As far as soft skills assessment procedures are concerned, one of the main limitations is the reliability of the assessment procedures. For example, in Clark et al. (2018), participants were selected based on good reliability. This decision might have influenced the Job Performance Rubric scores in the area of reliability of an employee.

The importance of soft skills in getting and keeping a job is now well recognized. However, there are not many empirically supported tools for assessing these skills for people with disabilities.

Due to the high specificity of the topic and the searching strategy for bibliographic material, the articles' analysis led to selecting a considerable number of contributions. A methodological limitation was that the psychometric qualities of the instruments described were not considered. Furthermore, including studies with participants with different diagnoses could make it difficult to generalize the results.

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