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Original Paper

Benefits of Life Skill Based Education for Neurodiverse Adults: An Integrative Review and Analysis

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Abstract

An integrative review and analysis was conducted to assess the benefits of teaching Life Skill-Based Education (LSBE) to Neuro Divergent Adults (ND) (i.e., adults with Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD) and/or specific learning difficulties (SLD)). A systematic search of Google, Google Scholar, EBSCO host, and Cochrane Library databases were utilized with date ranging from 2000-2020. A total of 659 hits were obtained before duplicates were removed and inclusion/exclusion criteria, as well as conceptual perspective applied. In summation, 16 articles were thoroughly analysed to evaluate the efficacy of LSBE programs on improving the Quality of Life (QoL) of ND adults. Specifically, ones that cater to the Executive Functioning (EF) challenges often seen in this population, whilst using inclusive approaches. The findings did reveal high potential of LSBE programs to benefit ND adults, where general services currently lack. However, issues such a small sample size and lack of sample diversity limit generalizability of program benefits. Recommendations are to tackle global problems around inclusion and education, for ND adults, at its roots. Greater awareness of LSBE program should be emphasized worldwide, as benefits will likely ensue for all kinds of individuals/neurotypes. Overall, implications target change on a micro, meso and macro level.

Keywords

life skill programs, education, neurodivergent adults, quality of life, executive functioning

1. Introduction

Education is one of the keys to empowerment; it enables groups to gain knowledge and understanding, to orient themselves for greater success in society and work environments (Behle et al., 2015; Li et al.,

2017; Ali & Jalal, 2018). One prominent social barrier in higher education is the low rates, and lack of accommodation towards disabled adults (Elias & White, 2018; Nugent & Smart, 2014). As stated by the United Nations' Convention on Rights of Person with Disability (CRPD: UN, 2006), disabled adults should have access to higher education on a non-discriminatory, and equal bases with others.

A form of education most supportive of developing skills to empower individuals is called "Life Skills Based Education" (LSBE). This is an approach that aims to cultivate greater Quality of Life (QoL) through evidence-driven, skill-based, learner-focused interventions that use practical and interactive methods to learning (UNICEF, 2003). Gerami (2015) reviewed studies of LSBE targeted towards high school students and evaluated the overall mental health outcomes of such programs.

The World Health Organisation's (WHO) Department of Mental Health state that LSBE should ideally be:

"*Designed to facilitate the practice and reinforcement of psychosocial skills in a culturally and developmentally appropriate way; it contributes to the promotion of personal and social development, the prevention of health and social problems, and the protection of human rights*" (1999, p. 3).

Furthermore, and as per Cronin (1996) systematic literature review, the outcomes of an effective LSBE programs can be measured by:

"*Analysing an individuals' level of enhanced community adjustment, independent functioning and QoL*" (1996, p. 53).

Life skill training can also provide various mental health benefits that meet the needs of modern society (Jamali, 2016). As we see deep cultural shifts, and changes in lifestyle, demands for life skill training increase (Gerami, 2015). Integrating digital skill training, and the digitalization of LSBE programs can further meet the technological demands of living in the 21st century (van Laar, 2020). Although research acknowledges and reports several benefits of LSBE-a potential lack of research in this area leaves several questions to why, and how it works unanswered (Jones, 2014; Nasheeda, 2018). We also reflect, layers of stigmatization and marginalization may prevent proper engagement in LSBE for disabled people.

1.1 Background

Since the Second World War, reports of mistreatment towards disabled peoples raised questions about the human rights, efficacy, and standard of care for the non-typical minorities (Kattari, 2020; Scull, 2011; Vaahtera, 2016). Societal views linked disability to deficit; needing "treatments" for a person to become "normal", or more "able" (Ritvo & Freeman, 1984). This medical perspective alienated disabled people, denying their daily living challenges and personal agency. In 1990, a new paradigm of "neurodiversity" offered a more holistic, diverse and person-centered approach to disability (Arnold, 2017). Among this was the notion that, the "*neurologically different* represent a new addition to the familiar political categories of class/gender/race and will augment the insights of the social model of disability". (Singer, 1999, p. 64; italics added by authors). Further clarification of any key terminologies can be found in the Appendix.

To explore ways in which we may help people with such "neurologically different" brains, some researchers suggest that Executive Functioning (EF) is a promising end ophenotype to assess (Craig et al., 2016). EF in essence, is an umbrella term used to describe a set of neurological based skills of mental control, and self-regulation needed to navigate daily activities (Luca & Leventer, 2011). For instance, met cognitive (working memory, planning, task monitoring, and organization) challenges are commonly seen in neurologically different (or "neurodivergent", n.d.) peoples such as those with Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD) and specific learning difficulties (SLD) (e.g., dyslexia) (Elliott, 2003; Johnston, Murray, Spain, Walker, & Russell, 2019; Roselló et al., 2020). A comprehensive list is clearly indicated in Figure 1 using Dawson and Guare (2016)'s devised model.

The reason ND individuals tend to struggle with EF is, in part, due to biological factors (Demetriou et al., 2018; Gillespie-Lynch & Bublitz, et al., 2017; Johnston et al., 2019; Jurado & Rosselli, 2007; Katz, Ogletree, & Shah, 2018; Luca & Leventer, 2011; Miyake & Friedman, 2012). Nonetheless, these skills can be taught, as various internal and external variables also play a role outside one's biology: "*to become executive can be considered developmentally as an unfolding transaction between increasingly differentiated neural networks and the behavioural interactions that take place in response to environmental, social, and learning demands*" (Hunter & Sparrow, 2012, p. 17). As we can see, teaching valuable life skills may help nourish this ongoing process.

Recent studies have found LSBE programs targeted towards marginalized individuals to be particularly advantageous and empowering (Sangeeth, 2019). Yet, such programs remain limited for those who need it the most. Teaching vital life skills in a positive and inclusive manner could bring out the true potential of ND adults. Three major themes, namely: to be understood, to understand the world, and to succeed was noted in a study of young ASD adults (Thompson, Bölte, Falkmer, & Girdler, 2018). Such principles of inclusivity should form the core foundations of LSBE programs for all ND adults. With the right guidance, EF can also be readily improved in adulthood, with promising outcomes (Mitchell et al., 2013; Smolker, Friedman, Hewitt, & Banich, 2018).

LSBE programs which focus on improving the EF, and QoL of ND adults (outlined in Figure 2) will, therefore, form the basis to our integrative review.

2. Materials and Methodology

2.1 Topic Definition

We have used Jackson et al., 2006's PICO/PECOT system of review to come up with the proposed question:

"In what ways do LSBE programs, targeted towards ND adults with EF challenges, improve their QoL on equal grounds to that of the typical population?".

Sub-questions include:

- "Do LSBE programs positively affect ND in higher education?"

- "Do LSBE programs enhance personal management, employment outcomes and social skills needed for daily living?
- Are LSBE programs tailored in an inclusive, culturally appropriate manner whilst addressing the autonomy and human rights of ND adults?"

The characteristics of participants has been laid out in Table 1—to distinguish the unique profiles of each group of participants before going on to measure the outcomes of LSBE programs (Demetriou et al., 2018; Katz et al., 2018; Rodríguez, González-Castro, Cueli, Areces, & González-Pienda, 2016).

Table 1. Characterisation of Participants (P of PICO) Across Executive Functioning (EF)

Neurotype of divergent adults (with subtypes)	Study	Executive Functioning Domains/Measures	Findings in Comparison to Typical Population
Autism Spectrum Disorder (ASD)	Demetriou et al. (2018) Meta-analysis of executive function across 235 studies from year 1980-2016. Compares EF in ASD adults with neurotypical population	Across behavioural, emotional, and cognitive domains of EF: • Concept formation (g= 0.57) *, p<0.001) ** • Mental flexibility (g=0.48, p<0.001) • Fluency (g=0.40, p<0.001) • Planning (g=0.27, p=0.02) • Response inhibition (g=0.49, p<0.01) • Working memory (g=0.40, p<0.01)	• Most studies based on BRIEF-A questionnaire. • Moderate effect size of executive challenges was seen in all individual domains for ASD population in comparison to typical population • Factors such as task characteristic, individual differences and co morbidities can vastly influence results.
	Wallace et al. (2016) A study analysing the real-world EF challenges of 35 (31 male) adults from 18-40 with ASD	• Struggled on all 9 domains of EF on BRIEF-A (T-scores; M = 50, SD = 10). • Planning/Organisation was of clinical significance.	• Found that one of the real-world EF challenges were associated with adaptive functioning (social communication and daily living skills) using ABAS-II scale and comparing with BRIEF-A outcomes.
	Johnston et al. (2019) A factor analysis of	• In support of hypothesis 1, adults with ASD took significantly longer to complete EF tasks. • Hypothesis 2 summarise	• In relation to our broad research question, investigating the presence and pattern of EF performance, across multiple domains of EF measurement found that

	(n=110) executive functioning in participants with ASD compared to (n=31) controls. Aim was to analyse cognitive and behaviour measures of executive functioning in adult ASD participants without cooccurring ADHD	participants with ASD compared to (n=31) controls.	adults with ASD had lower scores relative to matched controls across measures of planning (Zoo Map, Key Search), generativity (Hayling test, verbal fluency) and flexibility (Brixton).
Co morbid learning difficulties	Habib, Harris, Pollick, and Melville (2019) Meta-analysis of 29 papers analysing Working Memory (WM) across lifespan of participant with ASD compared to typical population.	WM difficulties contributes to challenges with: • Emotional regulating • Cognitive flexibility • Attention • Abstract thinking Commonly seen in individuals with comorbid learning difficulties	Difficulties in WM contribute to challenges with: • communicating and socialising • Navigation • Problem solving • Reading skills • Language and development
Comorbid ADHD	Plenty, Heurlin, Arlinde, and Bejerot (2013) A retrospective study reporting the challenge of adults with ADHD (*n*=130), ASD (*n*=57) and coexisting ADHD + ASD (*n*=56).	The ESSENCE approach was taken where understands the depths of symptom history of adults ADHD and ASD which can be useful to distinguish between their childhood experiences. The domains measure 8 areas, namely: (a)motor skills, (b)executive functions, (2) perception, (d)memory, (e) language, (f)learning, (g) social skills and	Difficulties of participants extended well beyond that described in the DSM-5. Childhood challenges reported from participants with both ADHD and ASD include: • Motor coordination • Sleep • Externalising/internalising behaviours • Communication and language (especially for ASD group)

		emotional/behavioural problems. "Social skills" and "communication" referred to mostly ASD traits, whereas "attention" and combined domains such as "hypoactivity/impulsivity" refer to ADHD traits.	• General development and executive functioning EF for ASD and ADHD differs in idiosyncratic ways. Comorbid group suffered to a greater extent. For instance, greater memory problems, starting and completing tasks and poor time management was associated with ADHD group and comorbid group, not ASD.
Attention Deficit Hyperactivity Disorder (ADHD)	Roselló et al. (2020) A descriptive, cross-sectional study of (*n*=115) adults with ADHD and (*n*=54) from the typical population on various EF domains	Executive functioning was measured on the BRIEF A, obtaining self-reports of cognitive, behavioural, and emotional EF from the participants in everyday situations. Other measurement scales for adults with ADHD includes the Barkley Deficits in Executive Functioning Scale (BDEFS)	Compared to typical population, severe challenges were observed in: • Occupational status • Daily functioning • Criminality • Some aspects of social functioning
	Holst and Thorell (2020) Daily functioning was assessed using self-ratings scale on (*n*=95) young adults, (*n*=50) with ADHD and (*n*=45) with other neurodiversities.	Neurological EF tests of inhibition, working memory and set shifting was analysed.	Challenges compared to typical population include restlessness, memory problems, emotional dysregulation, and low self-esteem.
Specific Learning Difficulties	Smith-Spark, Henry, Messer, Edvardsdottir, and Zięcik (2016) An experimental study which explored EF in	The BRIEF-A, self-reported test was administered, as executive functioning was evaluated across a range of laboratory studies. The nature of task accounted for phonological processing errors.	Participants with dyslexia reported more frequent EF problem in daily life centred around metacognition (working memory, planning, task monitoring and organization) rather than regulation of emotion and behaviour. Specifically, showing challenges with:

	adults with dyslexia (*n*=31) and without (*n=30).*	Paper reports in the past Stroop task was used to measure attentional challenges. Methods of current study include use of attention networks test—interactions to measure mathematical abilities, reading, attention and intelligence. Results showed struggles with facilitation, inhibition, and WM.	• Inhibition • Set shifting • Working memory Participants with pure developmental dyscalculia showed challenges in EF compared to typical population due to differences in alert network. Participants with dyscalculia only (not comorbid ADHD) showed different attentional challenges (not related to numeral processing) than those with ADHD. Possibly suggesting that certain aspects of developmental dyscalculia are domain general.
	Askenazi and Henik (2010) Examination the brain's alerting network and EF in (*n*=14) university students with dyscalculia and (*n*=14) without.		

Notes. * Hedge's *g* represents the effect size and relationship between one group with another- in this case ASD participants to neurotypical participants. It is preferred over Cohen's d for small sample data. Large effect size (*g*= 0.2), medium effect size (*g*= 0.5), and small effect size (*g*= 0.8)

A moderate overall effect size for reduced EF (Hedges' g=0.48, 95% Confidence Interval (CI) 0.43-0.53) was found with similar effect sizes across each domain.

** Represents the *p*-value which is the statistical significance of finding. In other words ($p<0.001$) is statistically significant.

2.2 Literature Search Strategy

In line with our proposed research question, an electronic database was searched using EBSCO host (inclusive of Academic Search Complete, ERIC, Education Research Complete, JSTOR, Professional Development Collection, Psychology and Behavioral Sciences Collection, Psyc ARTICLES, Psyc CRITIQUES, PsycINFO, Social Sciences Abstracts, Medline). In addition, Cochrane Library, and Google Scholar and Google was utilized. Peer review articles comprised of most findings; however, grey literature was also included. The literature search took place on 2 December 2020. Specific search strategy, and careful selection of the terms were entered as represented in Table 1. A total of 659 hits were obtained through databases and cross-referencing key terms from pastreviews. The language was restricted to English. Date range was set between 2000-2020. The search terms are represented in Table 2 below:

Table 2. Literature Search Terms

PICO Framework Breakdown	Category	Search Terms
Population	Neurodivergent	(a) autism OR ASD OR "autism spectrum disorder" OR asperger* OR aspergers syndrome autistic OR HFA OR pervasive developmental disorder OR PDDNOS (b) attention deficit hyperactiv* disorder OR ADHD OR ADD or attention deficit disorder (c) specific learning disabil* OR learning diff* learning disabil* OR SLD OR dyslexi* OR dyspraxia OR dyscalculia OR "specific learning disability" (d) neurodiver* OR neurodiverse* OR neurodevelopmental disorder OR neurodevelopmental disorder OR neuro developmental impairment OR NDD
Population #2	Adult	adult* OR young adult OR young people OR "university student" child* NOT adolescence NOT children NOT paediatric NOT teens
Intervention	Life Skill Programs (in accordance with Outcome)	(a) Self-determination- self-care skills OR strateg* AND self-help skills (b) Social Inclusion- social skills OR interven* OR program OR accomodat* (c) Material Wellbeing-"money management skills" OR employment program (d) Personal Development- functional academics OR functional curriculum OR functional literacy OR functional skills (e) Emotional Wellbeing- psychosocial skill* (f) Interpersonal Relations- community development OR community development skills (g) Rights life skills program OR life skill-based education OR LSBE AND coping skills AND survival skills (h) Physical Wellbeing-daily living* OR ADL*AND independent skills OR independent living NOT ABA or "Applied Behavioural Analysis" NOT medica* NOT pharma*
Comparison	Executive functioning (EF)	EF OR executive function* OR executive dysfunct* typical* OR typical population OR neurotypical AND organizational skill*
Outcome	Quality of Life (QoL)	quality of life OR QofL OR QOL

Notes. Various combinations of these search terms were deployed to obtain results. Key terms were used interchangeably.

2.3 Justification of Methodology

Integrative literature reviews analyze both theoretical and empirical findings (Russell, 2005), allowing for more practical, person-centred solutions to arise from a broader range of studies (Elsbach & van

Knippenberg, 2020). This is especially important within ND research, since there is an urgent need for real-world challenges to be addressed in a more inclusive manner, requiring the voices of ND adults to be integrated within programs (Camm-Crosbie et al., 2018). Nonetheless, assessing for feasibility, acceptability, and generalisability of findings is still important to establish more evidence-based solutions. This can only be done by looking at quantitative data too. Given the scope of an integrative approach over, for instance, a meta-analysis (which requires similar data), productive outcomes will likely ensue. It will allow us to answer the "how's" of our main PICO question (using more qualitative literature) and the "ifs" of subsequent questions (using more quantitative literature) effectively. The potential for bias and error of using integrative methodology can be mitigated using a systematic approach (Pope, Mays, & Popay, 2007). We authors feel the process is well justified, and robust, as italigns well with Okoli and Schabram's (2015)'s eight-step, comprehensive guide to systematic reviews. The analysis we take is embedded in scientific rigour, with use of established guides and checklists to evaluate papers (Herker, 2006; Jackson et al., 2006; Godlee & Dickersin, 2003).

3. Identification and Selection Process

After the initial list of 659 results were generated, 25 duplicates were removed using Zotero, leaving 634 articles to be analysed. Articles were also managed and reviewed using Endnote. Next, papers that did not meet inclusion and exclusion criteria were removed on three accounts: (1) 559 articles after abstract and title screening, (2) 46 articles excluded after full-text screening and (3) 12 articles excluded during data extraction. Thus, leaving 16 articles to be included in this systematic review. The screening processes has been provided in Figure 3.

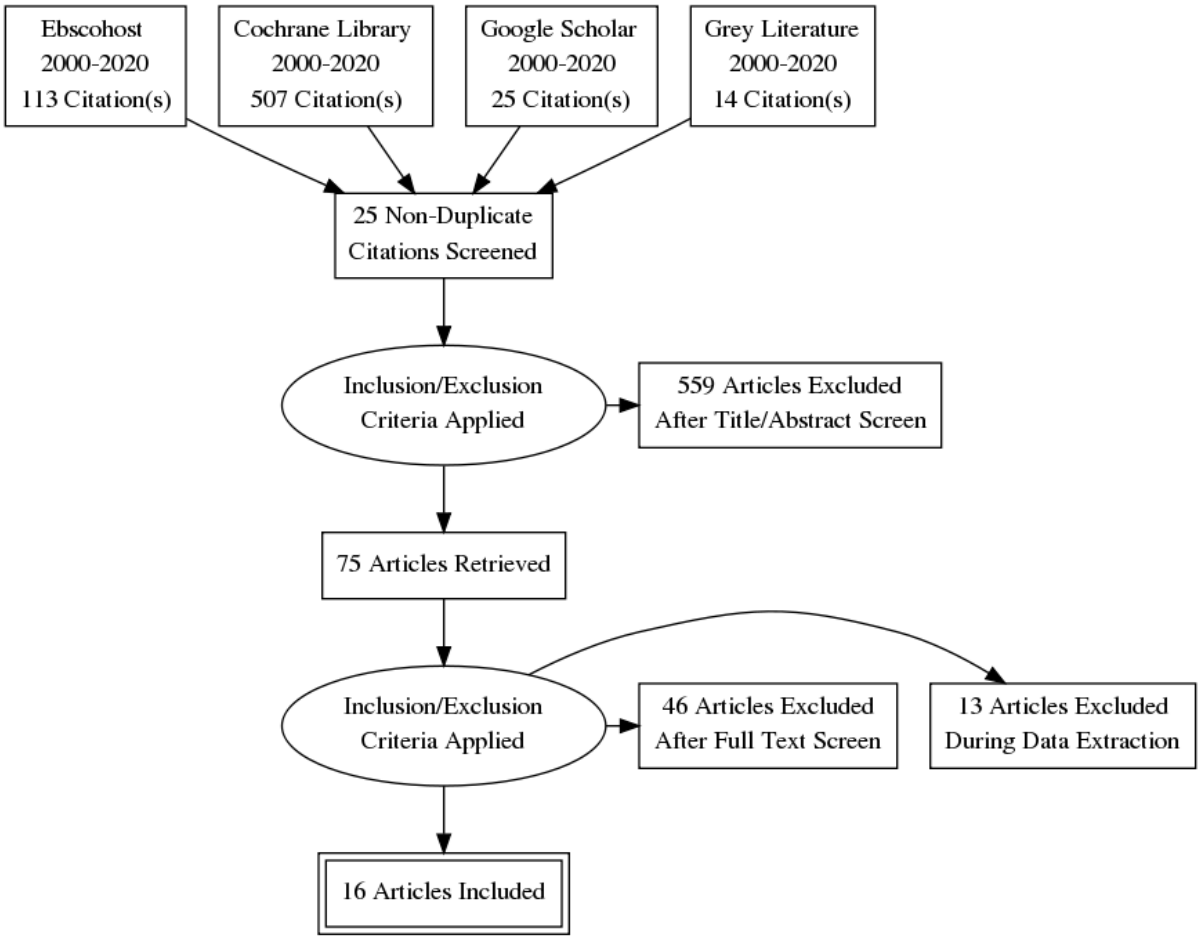

Figure 3. PRIMSA Flow Chart Showing the Selection Process for LSBE Programs

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

3.1 Inclusion and Exclusion Criteria

3.1.1 After Abstract and Title Screening

The included studies, after analyzing abstracts and titles, comprised of adult tailored programs from years 2010-2020. Several articles were excluded due to their focus on children, adolescence, or parents of children/adolescence-or simple were not in English.

Historically, most emphasis had been placed on ND children which has led to bias in helping adults (Camm-Crosbie et al., 2018). Our research aims to bridge this gap by not including children in our analysis, as it is adults with ND that face a "service cliff" (Oswald et al., 2018). Furthermore, articles which had a narrow biomedical focus, or were irrelevant to search criteria and participant demographic (i.e., people with other mental illness/disability such as schizophrenia or Intellectual Disability (ID)) were omitted. Programs conducted in schools and residential settings were also excluded. Low quality

grey literature was excluded. Although past literature reviews/meta-analysis on the topic proved to be useful to derive relevant search terms, these were excluded from further analysis.

3.1.2 After Full-Text Screening

After full-text screen, 16 articles were included for data extraction and quality assessment purposes. Despite meeting the requirements of our PICO question, several articles from Cochrane Library were excluded as they were protocols for future or ongoing research, and therefore outcome measures could not be obtained.

One article was excluded since it comprised of a case study with limited substance to the requirements of our PICO question. More importantly, articles which focused on the medical model had to be excluded as they do not fit the inclusive theme of our review-despite the potential quality of the paper. For instance, Laugeson, Gantman, Kapp, Orenski, and Ellingsen (2015)'s use of Empathy Quotient (EQ) scale to measure empathy outcomes in autistic indivuals is controversial due its grounds in the "theory of mind" hypothesis (Brownlow & O'Dell, 2009; Gernsbacher & Yergeau, 2019; Montgomery et al., 2016), and lack of standardized methods (i.e., replicability) (Harrison, Brownlow, Ireland, & Piovesana). Some articles have been included even though they subtly mention theory of mind in their introduction, because they do not include such principles into their program. Furthermore, Markham, Porter, and Ball (2013)'s concept seems to conjure up an innovated idea to teaching the vital LSBE of driving to adults with ADHD. However, their use of behaviour modification methods proves to be an age-old, controversial technique embedded in ableist ideals (O'Leary & O'Leary, 1977; Shyman, 2016). Modern autism research recommends avoiding such ideals to rise above bias, unjust and unethical practices (Kristen Bottema-Beutel, 2020), therefore such papers will be omitted out of this review before data extraction.

3.2 Data Extraction

To extract and appraise data of the 16 articles, we used the predetermined criteria of RAAMBO method as per Jackson et al., 2006's system of review. Tables were created using Word, and served as a tool to organise, and evaluate articles during the research process. We have split up the program by participants neurotype: (1) ASD, (2) ADHD and (3) ADHD & ASD combined; ADHD and LD combined. The characteristic of study, in accordance with RAAMBO, has been provided in Table 3 below:

Table 3. Data Extraction and Quality Assessment of 16LSBE Programs using RAAMBO (1)

Study& Program	**R**epresentation of sample	**A**llocation of intervention	**A**ccounting for participants	Accuracy of Outcome **M**easured
Baker-Ericzén et al. (2018) SUCCESS [Supported	-Small sample size (n=9; M_{age} = 22.44, SD = 3.55). Possibility of Type 1 error. -Participants meet	-An open trial design, therefore, no control group with ASD, or	-1 participant lost to follow up, therefore attrition bias*11% - All	-EF measured using D-FEK and BRIEF-A. -social and

Employment, Comprehensive Cognitive Enhancement, and Social Skill]program for adults with ASD	inclusion/exclusion criteria; 75% met ASD diagnosis on SRS-2 scale -However, EF (measured using BRIEF-A and D-KEFS self-reports) at baseline was lower than typically seen in ASD population. -Gender bias (78% male) and racial bias (75%) Caucasian	neurotypical population to evaluate strengths of findings -Allocation was not randomized -Participants split into two groups (n= 4 per group). -25 session conducted over 6 months teaching cognitive (EF) and social skills	participants/group treated similarly by facilitators. Program conducted in an individualized, person-centred manner. -Excellent group attendance at 63%	communication skills measured using SRS-2 and SSPA -daily living and vocational skills measures using Functional Daily Living Questionnaire and Employment Interview. -High rates of program satisfaction as measured by Participants Satisfaction Questionnaire
Capriola-Hall, Brewe, Golt, and White (2020) STEPS [Stepped Transition in Education Program for Students] for adults with ASD	-Small sample size (n = 32; M_{age} = 19.74) taking undergraduate/post graduate degrees. -Clinicians measure of ASD using ADOS-2, but not EF at baseline, with exception of emotional regulation DERS. -Participants meet our inclusion and exclusion criteria, but with co morbid anxiety and depression using DSM-orientated adults scales. -Gender bias (95% male) and racial bias (81% Caucasian).	-A block randomized control trial with participants assigned to STEPS or transition as usual (TAU) -Relatively similar baseline demographic of groups (pre-test) strengthens results. -Program conducted over 4-month period, teaching college students	-Mentions missing data which effected sample size on pre- and post-treatment. However, no other description of missing data or strategies to handle it.	- measures anxiety and depression using adult self-report (ASR) -Loneliness measured using UCLA self-report - Touches on areas of both EF and QoL by measuring emotional regulation using DERS (self-report) and self-determination using AIR-SD (self-report)

		self-regulation and self-determination skills by emphasizing self-awareness and acceptance of self, strengths-building, and goal-oriented behavior		-mention of why measuring loneliness (i.e., to improve loneliness and depression levels in par with NT population)
Crabtree and Demchick (2015) Outdoor Challenge Course program for university students with ASD	-Small sample size (n = 28; M_{age} = 22.14, SD = 4.08) -No mention of measures to evaluate ASD and EF in participant's baseline -Participants collected from autism advocacy groups and university campus -Gender bias (85.7% male)	-A mixed-methods sequential explanatory design was used -A non-randomized convenient sample with no control group. -Participants split up into 3 groups, as 3 differences sessions were conducted over the course of a year (4-6 weeks per course)	- 5 male participants dropped out before completing post-test: attrition bias 17.9%. Data analysis only included 23 participants. -All participants/group treated similarly by facilitators. Program conducted in an individualized, person-centred, and strength-focused manner.	-The study was guided by a theoretical lens of participatory occupational justice using subjective viewpoints -measures features of QoL (i.e., life effectiveness) using LEQ-H -Participants subjective, qualitative feedback of program was assessed -encourages community and social inclusion, personal development, and indirect domains of EF (problem solving and planning)
Hillier et al. (2017)	-Sample size (n = 52; M_{age} = 20.9) -ASD diagnosis screened for	-A qualitative analysis of	- The participants were treated and	-Measures psychological and

Supporting University Students with ASD	-No other mention of inclusion/exclusion criteria, or EF levels at baseline - Gender bias (98% male), and racial bias (86.5% Caucasian).	participant identified themes -There was a focus groups to measure functional changes in academic and social skills for 7 of 9 cohorts (n = 26). -Two coders identified themes of groups. -All participants treated similarly -No randomized allocation or measure of baseline -No control group to compare self-reports	analysed equally- and in depth. -Person-Centred Planning (PCP) was used -10 participants lost to follow up: attrition bias 19.2%. Data analysis only included 42 participants.	functional outcomes - EF such as time management, emotional regulation and social skills were taught and evaluated based on themes -Self reports using self-esteem (RSES), loneliness (UCLA), anxiety, and depression (CCAPS-32)
Miyajima et al. (2016) Frontal/executive program[FEP] for adults with ASD	-Small sample size (n = 15; M_{age} = 36.5, SD = 9.9) -ASD screen using DSM-5 and PARS and developmental history Participants meet inclusion/exclusion criteria of acquired neurodiversity. No mention of other comorbidity -EF, measured by BACS-J showed lower scores than typical population -Gender bias (71.43% male) in control group	-Randomized control trial to either FEP (for 6 months) or control who underwent normal psychotherapy, drug treatment and occupational therapy. -No significant intergroup baseline differences in age, years of education, amount of	-1 participant lost to follow up; attrition bias6.67% -All participants assessed and treated similarly	- Good measures of EF using BACS-J, WCST, and CPT; SCoRS-J, GAF, and LASMI for social functioning; and GSE for self-efficacy (elements of QoL touched upon) -Follow up investigation was needed to further validate strength of findings

		antipsychotic medication, sex, or IQ -No significant inter-group differences on baseline cognitive functioning, social functioning, and self-efficacy measures using (BACS-J, WCST, and CPT). -However, control group had significantly higher baseline score on LASMI social functioning (or like QoL regarding daily living)		
Nadig, Flanagan, White, and Bhatnagar (2018) Transition Support Program for Adults with ASD	- Small sample size (n = 30; M_{age} = 21.5, SD = 3.5) -ASD screened and measured at baseline using established ADOS-2, RPM and WASI scale. Further, parent report of WABS-II (intelligence) and SCQ (social competence) were used -Measure of QoL at baseline using self-determination scale, and social problem-solving using SP task. -Participants meet our inclusion/exclusion criteria well	-Randomized control trail using RAND on excel. Wait list control were given program at a delayed time interval. -No statistically significant differences on demographic or outcome variable at baseline	-4 participants lost due to follow up; attrition bias 13% -Unbalanced group across intervention and waitlist (allocation bias) -Follows recent guidelines on handling missing data. Authors reports on missing data and perform an analysis that is valid	-Curriculum was tailored to participants self-expressed needs in three areas: social communication, self-determination, and working with others. - Standardized, self-reports of QoL and self-determination

	(i.e., without ID). However, possible fake positive for psychosis co morbidity -Gender bias (58.8% male in intervention; 77.8% male in control group). No mention of race.		under a plausible assumption about the missing data. - Deploying well-adjusted statistically methods accounting for missing data. No statistically difference found between group due to missing data	scale (SDS). -Objective measures of social problem-solving using SP task, and cognitive problem solving (indirect EF measure) -QoL self-report scale used -No explicit measures of EF (more indirect)
Oswald et al. (2018) ACCESS Program: [Acquiring Career, Coping, Executive control, Social Skills] for adults with ASD	- Small sample size (n = 44; M_{age} = 25.1, SD = 6.4) -ASD screen using DSM-5, ADOS-2 and WAS-II -Participants meet our inclusion/exclusion criteria well (i.e., without ID). Some participants unaware of other co morbidity. Participants had comorbid anxiety and depression. -Gender bias (68.3% male) and racial bias (73.2% Caucasian).	-Randomized control trail to treatment (60%) or waitlist group (40%) -Baseline demographic of participant similar, however outcome variable at baseline not mentioned -Acceptability and fidelity of program was assessed showing high results	- 3 lost to follow up; attrition bias 9% -missing data from self-reports occurred, however from Social Coaches this was minimal -data was accounted for by using baseline-observation carried-forward (BOCF), a conservative method in which the pre-treatment baseline observation is treated as the final response. -All participants treated similarly; fidelity and acceptability of trail	-The program taught (1) skills for working in a group, (2) stress and anxiety coping skills, (3) self-determination skills and (4) adaptive and social skills -Informant reported measures on social adaptive functioning using ABAS-3 and self -determination (a component of QoL) -Self report of self-efficacy using CSES, and anxiety using DSM-orientated

			establish -Some participants did not return/complete self-reports	adult self-report (ASR) -No specific EF measurement.
Palmen, Didden, and Korzilius (2011) Outpatient group program on leisure lifestyle for ASD adults	- Small sample size (n = 12; M_{age} = 20.75, SD = 4.45) -ASD screen using DSM-4, and IQ using WAIS -Participants meet our inclusion/exclusion criteria well (i.e., without ID). No other mention of comorbidity reported. -Gender bias (83.33% male), no mention of race.	-A quasi-experimental design with control group. -Not randomized, based on order that participants applied for participation -Groups had similar demographic attributes but differences were not statistically reported.	-No mention of withdrawal or missing data -The intervention group were assigned to the leisure program, whilst controls received no intervention.	-Self reported questionnaires were used to measure: Need for (1) Leisure Support, (2) Engagement in Leisure Activities and (3) Satisfaction in Leisure Lifestyle. This indirectly relates to QoL. -Participants completed questionnaire of acceptability and effectiveness of program. -EF was indirectly measured on these self-reports, namely: making, arranging, executing, initiating, and planning leisure activities.
Ward and Esposito (2019) Virtual Reality Job	- Small sample size (n = 16; M_{age} = 19.8) -All participants had education and medical diagnosis of ASD; 12	-Exploratory study design with no control group, therefore no	-4 participants withdrew: attrition bias 25%	-Assesses material wellbeing component of QoL by measuring

Interview Training Program (VR-JIT) for adults with ASD	participants had IQ scores which fit out criteria -No other inclusion/exclusion criteria mentioned. No measures of EF at baseline -Gender bias (83.33%male), no mention of race	randomization. Examined pre-post changes in participants' SE and self-confidence specific to their perceived interview skills -Participants were a group of 12 students in a classroom setting. -VR-JIT program is a 45 minute session which teaches: interview skills, , displaying team work, being positive, being honest, showing interest in the job, being professional, and making a good impression.		employment outcomes .Indirectly assesses other QoL domains. -self-report on global self-efficacy (GSEF); interview self confidence survey; progress monitory with using virtual reality interview program (VR-JIT); student satisfaction with VR-JIT (92%) -Mention of strength pertaining to ASD population, and NT employment privilege as social barrier -No explicit mention of EF
Anastopoulos and King (2015) Accessing Campus Connections and Empowering Student Success [ACCESS] CBT and Mentoring	- Small sample size (n = 43) -ADHD diagnosed with DSM-4 and self-reports (ADHD RS and CAARS-S). Multiple methods (including semi structured, clinician-administered interview)were used to diagnoses, which was considered best practise. -Mets our inclusion (included LD;	-Open clinical trial, no control neurotypical population to evaluate strengths of findings -One case example was given -No randomization of participants	-3 participants dropped out 6.97% attrition bias (researchers considered this low)	-100% of participants completed post-treatment interviews (n = 30) stated that they would recommend ACCESS to other students with ADHD

Program for College students with ADHD	58% had at least one comorbidity like anxiety and depression) and exclusion criteria (i.e., bipolar and other psychiatric disorders) -Gender bias (62.8% female); racially diversity mentioned, but still small (16% Hispanic, 21% African American and multicultural backgrounds). Good diversity of pariticpants.	except to measure fidelity of study design		- Aim to provide (1) ADHD knowledge (psychoeducation), (2) behaviours strategies, and (3) cognitive therapy skills that will all consequently improve domains of daily functioning -EF assessed using BRIEF-A -psychological functioning, using Beck Depression Inventory–II and the Beck Anxiety Inventory. -GPA was measured for academic performance
Fleming, McMahon, Moran, Peterson, and Dreessen (2015) DBT Group Skill Training for ADHD College Students	- Small sample size (n = 33) -Social and Developmental history form given. -ADHD diagnosed with DSM-4 (4/5 symptoms required in one domain) and challenges in daily living. Two participants did not meet this. ADHD symptoms on Barkley Adult ADHD Rating Scale-IV (BAARS-IV) was also used to assess levels. -Mets our inclusion and exclusion criteria (i.e., bipolar and other psychiatric disorders)	-First RCT of intervention for college student till date. -Participant demographic, ADHD symptom logy, EF and other related variables evaluated at baseline using good statistical methods. Both groups had similar	-2 participants dropped out; attrition bias (6%) -Participants split into treatment vs skill handout (SH) group comparison treatment. Participants in the SH received 24 pages of self-help ADHD material related to EF.	-Self report (well-standardized with high internal validity) questionnaires measuring (1) EF using BADDS and (2) QoL using (AAQoL), (3) Anxiety and depression using (BAI) and (BDI-2), (4) Mindfulness (FFMQ) a

	-Gender bias (58.58% male) and racial distribution (58.8% White; other race include Latino, Asian, Black, multi-racial/other). Good diversity of participants.	baseline levels.		-Academic performance (GPA) -Performance-based task to measure EF domains (attention and inhibition) using CPT-2
Hartung et al. (2020) CBT program for college students with ADHD teaching organizational, time management, and planning (OTMP) skills	- Small sample size (n = 30) -23 ADHD diagnosed with DSM-5and other participants self-reported (using CAARS and WFIRS) substantial traits of ADHD. Comorbidities of ASD and learning difficulties, anxiety and depression also mentioned. -Mets our inclusion and exclusion criteria -Gender bias (57% male); racial bias (83.3% White/Non-Hispanic) -Exploratory analysis was conducted to evaluate sex difference, but non found. Good diversity of participants.	-Open trial with no comparison control group, or randomization. -Baseline measurement of ADHD traits and EF/daily living variables (using WFIRS) conducted -Combined groups (6-8 n total) and individual format of program deployed. Attendance rates were high.	- No mention of withdrawal or missing data -Participants were treated similarly, based and program tailored in an individualized manner	-Self report (well-standardized) on ADHD, EF Organizational, Time Management, and Planning (OTMP) Self-Report. -Academic performance was also evaluated, but not objective measurements were taken of grades. -Case example was given
Morgensterns, Alfredsson, and Hirvikoski (2016) DBT program for adults with ADHD	- Sample size (n = 98, M_{age} = 37.4, SD = 10.4) -ADHD and mental health records obtained. ADHD also measured using DSM-4 and Barkley-Self-Report scale. -Mets our inclusion and exclusion criteria (i.e., no ID, acquired neurodiversities or psychopathologies) -However, compared previous	-Open trial with no control group or randomization -Participants demographic and variables all measured at baseline (i.e., ADHD symptoms, daily living challenges and co	-Repeated ANOVA's done on missing data. -22 withdrew; attrition bias 22.25%. 14 lost to follow up; attrition bias 19.44%- but good sample size	- measures the complex set of problem often seen in this population -Self reports: -Measure of ADHD related challenge (relational to EF) using 3 differently Barkley ADHD scales.

	studies participants had lower educational levels, employment status, higher level of comorbidity and greater range of IQ levels, i.e., few individuals with very mild ID -Gender distribution (31.6% male) -Aimed to increase participant diversity through broadening inclusion criteria	morbidities of anxiety and depression (BDI and BAI). -14 weekly group session of 8-10 individuals per group		-Sleep, stress, mindfulness and disability measured using PSS,KSQ, MAAS, AAQ and Sheehan disability scale -QoL measured with the Adult Attention deficit/hyperactivity disorder Quality of Life scale (AAQoL) -Goof feasibility and high treatment acceptability
Salomone et al. (2015) Self-Alert Training (SAT) program for adults with ADHD	- Sample size (n = 52) -ADHD diagnosed with DSM-4 (CAADID for adults) and WAIS-III. Furthermore, CAARS and WURS rating scales were given to assess ADHD symptoms in adults. -Observer versions of scales were given to close family members or partners; self-reported clinically significant baseline measures of executive challenges leading to daily living were evaluated - Mets our inclusion and exclusion criteria (i.e., no ID, acquired neurodiversities or psychopathologies) -Gender bias (70.6% male); racial bias, all participants were White.	-An RCT novel protocol of SAT involving initial practise in lab then at home environment. -Thorough baseline measures for both demographic and attributes. Groups were similar. -Study included three assessments (pre-training, post-training after 5-weeks of intervention, 3-month follow up)	-14 dropped out during study; attrition bias 27.45%. Further 8 dropped out during follow up period; attrition bias 21.62% -Groups were treated similarly throughout the trial	-Performance based objective measures: -Executive functioning was measured using two subsets of Test of Everyday Attention (TEA) which evaluated selective and divided attention. The Hotel Task measured EF in general and designed to stimulate typical day-to-day. -Standardized psychological tests: Generalized Self Efficacy Scale

				(GSES), Beck Anxiety Inventory (BAI) -Subjective self-raters: Attention-Related Cognitive Errors Questionnaire (ARCEQ), The Memory Failures Questionnaire (EMFQ) -Overall focus on how to improve QoL
Farmer, Allsopp, and Ferron (2015) Personal Strengths Program (PSP) for adults with learning difficulties and/or ADHD	- Small sample size (n = 11) -All participants documented diagnosis of LD/ADHD (with type) - Participants meet inclusion/exclusion criteria. IQ is evident by looking at grades (university/graduate students majoring in education, anthropology, business, psychology, and criminology) -Manifestation of disability described EF domains. -Participants strengths were recorded -Gender ratio was not reported explicitly in numbers. However, names were reported which showed similar gender distribution.	-Single case intervention research -Multiple baseline design with fixed baseline and intervention phase lengths -No control group (for ethical reasons) but there was shorter and longer baseline group (intervention conducted at different intervals) allowing for comparison. -Participants who	-2 participants withdrew; attrition bias 18.18% -Participants treated similarly, and individually tailored -Three graduate students trained by the lead researchers who completed fidelity of implementation checklists for PSP using a random selection of 25% (n = 14) of fidelity established at 93%.	-Self reports on standardized Self-Determination Student Scale (SDSS), component of QoL -Researchers completed objective session notes on each PSP session: reflection on progress, long-term goal, short-term goal, planning to achieve, monitoring plan, strengths engaged, and strategies taught (domains of EF). Inter-rater

		withdrew (n = 2) were assigned randomly to longer baseline group. -Baseline demographic of participants not sufficiently explored -Baseline of self-determination levels were evaluated. Each individual demonstrated a "predictable baseline pattern"		agreement 91% -Researchers conducted interviews with all participants at the completion of PSP to gather information about the social validity of the program.
Jonsson et al. (2019) TRANSITION program for adults with ASD and/or ADHD	- Small sample size (n = 26; age 17-24). -All participants had education and medical ASD/ADHD diagnosis according to ICD-10. ASD (n = 8), ADHD (n = 4), or both (n = 14). Two participants had addition diagnosis of learning difficulties. -Meets inclusion/exclusion criteria mentioned (i.e., no ID or severe psychopathology). Baseline EF not measured. -Aim to reflect diversity of neurodivergent adult population by recruiting participants with diverse gender, functional impairment, comorbidity, and social adjustment. No measures of EF at baseline	-Open feasibility study without control group -No mention of randomization. -Baseline demographic and outcome variable were compared and analysed using Goal Attainment Scaling (GAS) and QoL scale. Robust statistical methods were reported. -Different recruiting methods were used to increase diversity	-5 participants withdrew: attrition bias 19% -Groups were treated similarly through the intervention, and outcome measured for all	-Self reports on QOLI: Quality of Life Inventory (7-preselected life domains of work, education, finance, housing, health, leisure, and relationship); GAS: Goal Attainment Scaling obtained (indirectly accounts for "goal directed assistance" of EF) -Safety and harms were accounted for. 5 adverse events reports, 1 of which related to

	-Gender equal (50% male, 50% female). Swedish study (cultural diversity)	of participants		intervention (i.e. a participant with a general medical condition feeling worse in related to a set goal). -The programme was shown to be feasible in clinical practice, with a high degree of attendance throughout.

Table 3. Data Extraction and Quality Assessment of 16LSBE Programs using RAAMBO (2)

Study& Program	Is the study **b**lind?	**O**bjectivity of Study/Limitations	**Quality Assessment**	**Main Outcome**
Baker-Ericzén et al. (2018) SUCCESS [Supported Employment, Comprehensive Cognitive Enhancement, and Social Skill]program for adults with ASD	- No, but coders of SSPA and D-KEFS had no relationship with participants at the time of assessment and were the same rater at baseline and post-intervention.	-Utilised standardized self-report measures given to participants and their parents -SRS-2 objectively measures social difficulties -SSPA is a performance based, objective measure	-Mostly **low**, but outcome measurement was of high quality -Pilot randomized control of program is on the way	-Statistically significant increase on measurement outcomes except daily living (with exception of work) -SUCCESS found to be feasible, acceptable, and highly satisfactory. -Participant employment rates increase from 22% to 56%. -Large increase in the mean number of hours worked per week (from 6 to 20 h a week) with individuals receiving competitive wages (US$10–US$18 an hour).
Capriola-Hall, Brewe, Golt, and White (2020) STEPS	-Not blinded	-Although the measures were standardized, study just used subjective self-reports. -No information on	-**Medium** to High	-Participants did show a statistically significant decrease in depressive, but not anxiety symptoms compared to control group. Also, STEPS was

[Stepped Transition in Education Program for Students] for adults with ASD		response rate		associated with reduction in loneliness. -Positive relationship was seen between (1) self-regulation and anxiety, and (2) self-determination and depression
Crabtree and Demchick (2015) Outdoor Challenge Course program for university students with ASD	-Not blinded	-Both quantitative and qualitative data received and analysed. -Measures of self-reports standardised. -Using typical peers to mentor neurodivergent adults on social skills may be seen as non-inclusive if not done properly. However study did utilised an occupational justice framework.	-Mostly **low,** but outcome measure was of medium quality	-Significant findings relating to leadership, social competence, and emotional regulation -Qualitative feedback suggests that peer relationship (with neurotypical mentors) is key factor for social competence -Implication could likely create flow-on effect to community integration. -Positive integration could ultimately lead to greater self-perception on QoL for adults with ASD
Hillier et al. (2017) Supporting University Students with ASD	-Yes, the focus group a collaborator who did not have direct involvement with the program and who had not previously met the participants.	Psychological scales were standardized. - Subjective themes were retrieved	-**Medium** quality	-Five prominent themes were identified in the focus-group analysis and reflected how the program had positively impacted participants' skills and coping: EF; goal setting; academics and resources; stress and anxiety; and social. -Positive participant feedback with only 2 saying they would not recommend program -Statistically significant increase of self-reported psychological outcomes

Miyajima et al. (2016) Frontal/executive program[FEP] for adults with ASD	-No mention of blinding	-Objective, performance based tasked administered and standardized self-reports measure findings.	-**High** quality expect for sample size	-After completion of frontal/executive program, the intervention group showed improved performance on BACS-J for overall score, digit sequencing, verbal fluency, and Tower of London tasks. Improvements were also seen on SCoRS-J and LASMI scales of social functioning.
Nadig, Flanagan, White, and Bhatnagar (2018) Transition Support Program for Adults with ASD	-Single blind except lead facilitator	- 1 year follow up data was collected. Response rate only 26% -Both objective based performance tasks and standardized self-reports were administered	-**Medium** to High	-Study aimed to improve independent and teach flexible life skills to ASD adults. -Participants did show statistically significant increase self-determination (SDS) compared to controls -Participants did show higher QoL scores than control -Participants did show higher performance on Social-Problem-Solving task than control -participants and their parents showed favorable outcomes in social communication, self-determination, and working with others. However, no control data to compare this outcome.
Oswald et al. (2018) ACCESS Program:	-Not blinded	-The ASR scale for anxiety is more appropriate for neurotypical youth. It may not be standardized properly for ASD	-**Medium** to High	-Participants in treatment group scores significantly higher on ABAS-3 and self-determination compared to controls No statistically significant results were seen in self reports of ASR

[Acquiring Career, Coping, Executive control, Social Skills] for adults with ASD		adults. -Only subjective self-reports or informant measures used. Response rate 30-40% -Potential rater and performance bias (limitations reported well)		and Self-efficacy scores. Could be a result of low participant response rate (approx. 30-40%)
Palmen, Didden, and Korzilius (2011) Outpatient group program on leisure lifestyle for ASD adults	No mention of blinding	-Only standardized self-reports deployed	-**Low** quality	-Participants in leisure programs showed less need for support around EF of leisure activity. -Statistically significant decrease for support on making leisure choices was seen in program group -No statistically significant findings on executive and initiating leisure activities, or planning leisure during holiday -Increase with satisfaction with leisure lifestyle for leisure program participant compared to controls -control group showed no significant change on need for leisure support and satisfaction with leisure lifestyle over time -Overall leisure participants engaged in more leisure activities overtime
Ward and Esposito (2019)	-Not blinded	-Both standardized self-reports and subjective evaluation of	-Mostly **low** but measurement	-Highly significant positive correlation with GSEF and comfort with interview. Total time

Virtual Reality Job Interview Training Program (VR-JIT) for adults with ASD		program progressed charted in the VR-JIT database.	was of high to medium quality	using VR-JIT showed a significant positive correlation with total interview skills.
Anastopoulos and King (2015) Accessing Campus Connections and Empowering Student Success [ACCESS] CBT and Mentoring Program for College students with ADHD	-Not blinded	-Standardized, subjective self-reports	-**Medium** to High quality	-There were clear improvements in the hypothesized mechanisms of clinical change (i.e., ADHD knowledge, behavioral strategies, adaptive thinking), representing large to very large effects. -Medium to large effects were also associated with the significant improvements observed in self-reported ADHD symptoms and executive functioning. -Trends approaching statistical significance further suggested that ACCESS may contribute to improvements in emotional functioning. Also emerging from the data was preliminary evidence of real-world educational benefits (increase GPA), along with increased utilization of campus resources.
Fleming, McMahon, Moran, Peterson, and Dreessen (2015) DBT Group Skill Training for ADHD College Students	-Single blind	-Both standardized self-reports and objective, performance-based measures were deployed	-**High** quality except medium quality sample size	-When compared with SH, DBT group skills training appears to be efficacious in improving several key markers of ADHD impairment. Based on intent-to-treat analyses, individuals receiving DBT group skills training showed a greater improvement in EF and quality of life, with trends toward greater

				improvement in inattentive and total symptoms of ADHD.
Hartung et al. (2020) CBT program for college students with ADHD teaching organizational, time management, and planning (OTMP) skills	-No mention of blinding	-Only self-reports, no objective measures	-**High** quality except medium quality sample size	-Significant improvements in core struggles. -Participants reported diminished inattention, total and specific self-concept impairment, memory problems, and also greater use of OTMP skills. -Gains in attentiveness and OTMP skills were the most notable, with effect sizes that were approximately moderate. -Good qualitative feedback from participants
Morgensterns, Alfredsson, and Hirvikoski (2016) DBT program for adults with ADHD	-No mention of blinding	-Only standardized self-reports used, no clinical observation or performance-based measures	-Mostly **high** quality	-The efficacy-related measures showed significant improvement in all parameters with the exception of anxiety from baseline (T1) to post-intervention (T2). These improvements were maintained at the 3-month follow-up (T3), with the exception of perceived stress. -effect sizes indicated medium-large to large effects. In ADHD—symptoms we observed a symptom reduction corresponding to 16 % of baseline symptoms.
Salomone et al. (2015) Self-Alert Training (SAT) program for adults with ADHD	-Double-blind study	-Objective performance-base and subjective self raters were administered.	-Mostly **high** quality	- SAT group reported improved subjective ratings of everyday life attention at both assessment points. This pattern of results suggests that SAT may be beneficial for ADHD adults on a psychological and EF level.

				-Significant differences on improved self-efficacy ratings indicating that SAT can instil confidence in participants' ability to have control over their challenges. -Also consistent with previous studies on improvements of EF and selective memory; can also improve psychological wellbeing (i.e., anxiety and depression levels) Consequently, resulting in an overall QoL. -Real world EF application and novel findings (i.e., "to our knowledge, no neurofeedback studies have implemented techniques to promote generalization to daily life"). Results sustained after the 3-month follow up period
Farmer, Allsopp, and Ferron (2015) Personal Strengths Program (PSP) for adults with learning difficulties and/or ADHD	-No mention of blinding	Standardized reports on SDSS, subjective observational analysis by research, interviews coded, and subjective evaluation of program	-**Low** quality	- Impact and social validity of PSP on self-determination was evaluated. - Results indicate that the participants believed PSP led to an increase in self-determination levels. All participants stated that PSP was beneficial.
Jonsson et al. (2019) TRANSITION	-No mention of blinding	-Standardized, subject self-reports	-**Medium** quality	-All participants who completed the whole programme exceeded their expectations in at least one life

program for adults with ASD and/or ADHD	domain. -Participants and mentors/group leaders mainly viewed the intervention favourably, but also provided valuable feedback that will guide further improvement -Limitations include lack of independent outcome rater, session recording and fidelity assessment

Notes. *attrition bias ≤ 5% usually no concern; 5%-20%possible concern; and ≥20% may be cause for concern (Schulz and Grimes, 2002).

3.3 Quality Assessment

To assess quality of papers we analysed for potential biases as per Herker (2006) and Godlee and Dickersin (2003), which included: recruitment/selection bias, allocation bias, maintenance/performance bias, exclusion/attrition bias, measurement/detection bias and publication bias. We also looking at study limitations and other pre-determined sets of criteria using the National Institution of Health (NIH, 2014) took kit. This tool kit was used as a guide to assess the wide variety of study designs evident in our review. The results have been categorized into 5 low, 6 medium, and 5 high quality papers, and integrated within Table 3. Due to the level of infancy in this research area, however, us authors have revised papers with a degree of leniency. For instance, much of what has been reviewed are open clinic pilot studies so finding many studies with large sample size/randomization have not been possible. Quality has been adjusted for as study designs of programs vastly vary.

3.4 Conceptual Perspective

In reviewing the literature, we authors reassert a rejection of the medical model, and instead, we have taken a more person-centred, strength-based approach. We believe that this will provide for an inclusive, diversity-focused exploration of programs (Robertson, 2009). Studies that take ground in deficit, anthologizing language have been omitted due to their contentious nature. An example of this would be studies that recommended, or take on from Applied Behavioural Analysis (ABA)- as it often crosses the thin line between intervention and abuse that stems from historical malpractice (Kirkham, 2017; Robison, 2020). Furthermore, programs funding by controversial organisation, such as *Autism Speaks*, have been rejected. One exception has been made where it has been disclosed that the authors have little to no affiliation with the organisation (Crabtree & Demchick, 2015). Furthermore, the study followed the theoretical lens of occupational justice, which meets the inclusive requirements of our review (Gail, Katherine, Cindy, & Aakifah, 2018).

A plethora of limitation such as methodological flaws, false starts and non-inclusive samples (such as gender-bias and racial bias) has led to the inaccurate representation of ND adults (Beck, Lundwall, Gabrielsen, Cox, & South, 2020; Beery & Zucker, 2011; Helmer, Schottdorf, Neef, & Battaglia, 2017; Milner, McIntosh, Colvert, & Happé, 2019; Quinn & Madhoo, 2014; Rogers, 2010). Many women often do not get believed about their challenges, and are misdiagnosed, which leads them to suffer in silence (Bargiela, Steward, & Mandy, 2016; Beck et al., 2020; Helmer et al., 2017; Kuzminski et al., 2019; Leedham, Thompson, Smith, & Freeth, 2020; Olkin, Hayward, Abbene, & VanHeel, 2019; Rogers, 2010). As a result, already marginalized individuals are excluded/discriminated from services that will likely benefit them the most (Holthe & Langvik, 2017; Matheson, Foster, Bombay, McQuaid, & Anisman, 2019).This has led to several repercussions such as: alarmingly high rates of suicide amongst women, and alack of access to healthcare and higher education for women and racial /ethnically diverse individuals (Camm-Crosbie et al., 2018; Cassidy et al., 2019; Kirby et al., 2019).

Programs that are more inclusive have reported benefits for all genders, equally, and is therefore more advantageous (Rucklidge, 2010). We authors feel it is only fair to report extensively, and critically on the demographic of sample and how representative it is of the overall population. In better words, does it only cater to the highly unrepresentative WEIRD population (Western, Educated, Industrialized, Rich and Democratic) (Pollet & Saxton, 2019; Rad, Martingano, & Ginges, 2018)? As mentioned by Azar (2010),—in the American Psychological Association (APA) website-*"WEIRD societies represent as much as 80 percent of study participants, but only 12 percent of the world's population—are not only unrepresentative of humans as a species, but on many measures they're outliers"* (Azar, 2010, p. 1). In conclusion, our findings, and results with be discussed in line with this conceptual perspective. We will assess the level of full-representation/participation, opposed to partial representation/participation, of ND adults in programs (Matthew, Emily, Amy, & Dominic, 2020).

4. Results and Discussion

The current review covers both empirical, and qualitative studies which address LSBE for ND adults with ASD (9 programs), ADHD (5 programs), combined ASD/ADHD (1 program) and comorbid learning difficulties (1 program). The findings have been coded, and outcomes analysed in relation to our conceptual perspective, and PICO question.

4.1 Demographic, Diversity, Inclusion and Human Rights

All LSBE programs for adults with ASD had a gender bias (68%-98%) favouring males. Some programs failed to report racial diversity, whilst others showed clear bias (73.2%-86.5%) favouring Caucasians. Miyajima et al. (2016)'s program was conducted in Japanese population- and is therefore indicative of how LSBE programs can and should be implemented cross-culturally. No ASD program in our review reported on gender bias in limitations. Only Capriola-Hall et al. (2020)'s program reported the consequence of racial bias. This raises some ethical concerns, and human rights issues around programs towards ASD individuals (Treweek, Wood, Martin, & Freeth, 2019). Possible explicit and implicit bias

may be at play-which often exist when identifying, and/or stigmatizing ASD individuals who do not fall within a "stereotype" (Obeid et al., 2021). Other factors such as how gender bias plagues the field of scientific research could also be contributing to some deep rooted bias's (Bargiela et al., 2016; Baruah, Singla, Narwat, Das, & Chapadgaonkar, 2018; Coleman & Hong, 2008; Helmer et al., 2017; Larrazabal, Nieto, Peterson, Milone, & Ferrante, 2020; Quinn & Madhoo, 2014; Rogers, 2010; Warrier et al., 2020). Based on findings, researchers may not be immune to such bias's when recruiting ASD participants. Even if the programs have good intent, when they only cater to potential outliers it is ill-representative of the population at large. In comparison, ADHD and combined type programs had a much bigger sample size, except for Farmer et al. (2015)'s Personal Strength Program (PSP). Programs for adults with ADHD and combined types were much more diverse with only Salomone et al. (2015)'s Self-Alert Training (SAT) program showing gender and racial bias. All other programs attempted to increase participant diversity with fruitful outcomes as a product of inclusiveness. Another negative with programs, in general, is the lack of socio-economic-status reported. It is rather implied that most participants are recruited from affluent backgrounds. Nonetheless, increasing participant diversity tends to increase sample size, allowing generalizability and feasibility of programs to be more apparent.

4.2 Programs for ASD Adults (Improved EF, Daily Living and QoL)

In comparison to typical population, adults with ASD struggle with social communication, adapting to change and often experienced several co-occurring mental health challenges (Demetriou et al., 2018; Johnston et al., 2019; Wallace et al., 2016). Some programs address specific areas, whilst others have touched on many. For instance, Miyajima et al. (2016) program addresses EF in detail (i.e., verbal fluency, flexibility) but also links it to outcomes of social functioning. Others, such as Baker-Ericzén et al. (2018), addresses all three areas more broadly, namely: cognitive enhancement (EF), social skills and employment (daily living).Important vocational outcomes pertaining to daily living were well catered to around: employment (Baker-Ericzén et al., 2018; Nadig et al., 2018; Ward & Esposito, 2019), education (Capriola-Hall et al., 2020; Hillier et al., 2017; Nadig et al., 2018) and leisure (Crabtree & Demchick, 2015; Palmen et al., 2011). All programs were structured in an inclusive manner. Several benefits were reported and are indicative of how LSBE programs can positively affect ASD adults.

A common theme of programs was around improving self-determination levels (a QoL domain) of participants by focus on self-confidence, self-esteem, and self-efficacy (Capriola-Hall et al., 2020; Nadig et al., 2018; Oswald et al., 2018). Targeting this domain seemed to have flow on effects to improving mental health issues such as anxiety, depression and loneliness commonly seen in this population. Another common theme of programs was around social functioning (Baker-Ericzén et al., 2018; Capriola-Hall et al., 2020; Crabtree & Demchick, 2015; Hillier et al., 2017; Nadig et al., 2018; Oswald et al., 2018; Ward & Esposito, 2019). Specifically, teaching skills of leadership, group work, communication, interviewing and other such soft skills needed in everyday life. Interestingly, Ward and Esposito (2019) used Virtual Reality (VR) technology to teach interview skills which shows how LSBE programs can be creative in deploying their methods.

Programs consisted of pilot (Fleming et al., 2015; Nadig et al., 2018; Oswald et al., 2018; Palmen et al., 2011), or low scale studies (Baker-Ericzén et al., 2018; Capriola-Hall et al., 2020; Crabtree & Demchick, 2015; Miyajima et al., 2016)- except for Hillier et al. (2017) with (n = 52). Consequently, a huge limitation revolved around the small sample size. Furthermore, only one program analysed the long-term effects of findings (Nadig et al., 2018). Based on statistical power and lack of generalizability, strength of findings was weak despite positive feedback from participants (Baker-Ericzén et al., 2018; Hillier et al., 2017; Oswald et al., 2018; Palmen et al., 2011; Ward & Esposito, 2019). Although the programs were structured well and addressed several important areas, is advised to take results from these studies with caution until larger scale studied can be administered.

4.3 Programs for ADHD Adults (Improved EF, Daily Living and QoL)

Compared to the typical population, adults with ADHD struggle in several areas of EF relating to attention, memory, restlessness, time-management, set shifting and emotional dysregulation (Holst & Thorell, 2020; Roselló et al., 2020). As such, they are more prone to lowered self-esteem, sleep problems, anxiety, and depression (Cook, Knight, Hume, & Qureshi, 2014; Michielsen et al., 2013). Moreover, students with ADHD are often faced with the pressure of performing well at university, to the best of their ability and capacity, despite a lack of accommodation and/or recognition for their challenges (Kwon, Kim, & Kwak, 2018; Taylor, Esmaili Zaghi, Kaufman, Reis, & Renzulli, 2020).

Two LSBE programs were conducted in lab and outpatient settings (Morgensterns et al., 2016; Salomone et al., 2015), whilst the other three programs were pilot studies conducted in a university setting and addressed areas around education (Anastopoulos & King, 2015; Fleming et al., 2015; Hartung et al., 2020). As many adults with ADHD tend to be on medication, another life skill relevant to this population is around its use and regulation (Karlstad et al., 2016; Martinez-Raga, Ferreros, Knecht, de Alvaro, & Carabal, 2016). Many program have included this element, by teaching participant about how to regulate their medicine using psycho educational methods (Hartung et al., 2020). All programs recognize the positive, long-term benefits of LSBE (due to it multimodal approach), where other modes of treatment (such as just pharmaceuticals) may fail or lack in some shape or form.

Although adults with ADHD do struggle with social communication compared to typical peers, their difficulties are generally not as pronounced as with ASD adults (who struggle with pragmatics), and occur for different reasons (relating to EF) (Bora & Pantelis, 2016). Many LSBE programs were conducted in a group environment which help create a sense of social belonging and help with these skills (Morgensterns et al., 2016). Furthermore, much like with ASD programs, many ADHD programs touched on the QoL domain relating to self-determination, which often creates flow on effect to mental health benefits (Salomone et al., 2015).

Although the papers were of medium-high quality, implementing LSBE programs that address real world challenges for ADHD adults is a relatively new concept, and have only been studied over the last 6 years (most studies conducted in year 2015). As such, several limitations do exist. For instance, Morgensterns et al. (2016) reported that many participants felt organizational and daily living challenges were not

sufficiently addressed, and would also have benefited from more psychoeducation. Salomone et al. (2015) could have used better scales (such as the Goal Attainment Scale) to measure the outcomes of daily living, and Fleming et al. (2015) findings could have been more robust if conducted on a larger sample. Furthermore, other areas around daily living such as employment or recreational were not explored, despite a growing need (Roselló et al., 2020). In conclusion, the potential of these programs is high (i.e., fairly time and cost effect) if future research attempts to address the gaps of past literature, whilst addressing social challenges when tailoring new programs.

4.4 Programs for Combined ASD/ADHD Type (Improved EF, Daily Living and QoL)

Given the high prevalence of the ADHD and ASD comorbid neurotype being an at-risk group for greater EF challenges (especially inhibition, attention and WM), and compromised QoL, LSBE programs for this population are especially warranted (Berenguer-Forner, Miranda-Casas, Pastor-Cerezuela, & Roselló-Miranda, 2015; Plenty et al., 2013; Polderman, Hoekstra, Posthuma, & Larsson, 2014). Yet, as evident by this review, there remains a scarcity in services for this population which is reflective of the recency in recognising the population's existence (Antshel & Russo, 2019). For instance, it was only in 2013 that the DSM recognised that ASD and ADHD can, and often do, coexist (Young et al., 2020)

Jonsson et al. (2019)'s TRANSITION program, based in Sweden, addresses these issues well, in a culturally appropriate manner. The program was received positively by participants and staff, who also provided feed back to guide future improvements. Moreover, all participants were highly diverse in nature. TRANSITION also adapts principles of the social model of disability, by identifying that the problem exists within our society because of poorly coordinated services:

"to enable young people with NDDs to live fulfilling lives, it is crucial that major institutions in society adapt to diversity and facilitate a more sustainable person-environment fit" (Jonsson et al., p. 10).

The positives of the program include the wide range of QoL domains that are addressed, namely: work, education, finance, household management/housing, health, leisure/participation in society, and relationships/social network. The program acknowledges that several EF challenges exist in this population, but does not explicitly measure them, or structure it within the course. An exception is seen with goal-directed persistent, which is measured using the robust, standardized Goal Attainment Scale (GAS). The results showed that all participants did exceed on at least one QoL life domain, with those in the lower ranges showing a significant increase. However, long term effects of programs were not measured. The program did encourage meaningful participation, by addressing challenges with daily functioning and health outcomes. Psycho education (by employing a guest speaker to share lived experience), social skill training, and Acceptance and Commitment Therapy (ACT) were integrated within program. Multidisciplinary approach was deployed; thus, outcomes can be applied to a range of service settings including mental health and social services.

Caution needs to be applied with results as there were several limitations to study's generalizability and strength of findings. The study does not sufficiently address the unique EF challenges that this

neurotype tends to face in line with past literature. The study also lacks an independent outcome rater, session recording, and fidelity score. Sample size was small and missing data was evidence around participant demographics, such as IQ.

4.5 Programs for Learning Difficulties (Improved EF, Daily Living and QoL)

Programs appear to be scare for this population. Only one program, from Farmer et al. (2015)'s low quality paper, was tailored towards adults with LD in an inclusive manner, using a Personal Strengths Program (PSP). The program was conducted on university students and consisted of mostly participants with comorbid LD and ADHD. One participant did have just LD, and one just ADHD. There was no mention of how these two participants had their different attentional challenges catered to. The study did not explore how specific characteristics, such as initial self-determination levels, or neurotype impacted results.

The core EF challenges face by this population were broadly addressed within program structure (i.e., emotional control, organization, meta-cognition, and goal directed persistence), but not explicitly measured. The program did little to address other common EF challenge around: facilitation, inhibition, Working Memory (WM), attention and organisation-commonly seen in this population. However, the by-product of addressing meta-cognition and emotional control were explicitly measured using the self-determination component of QoL. Typically, ND adults show lowered self-determination levels as course progressed and academic demands increase. However, results -using multiple measures- showed participants in the PSP reported stable self-determination levels throughout which suggests this program may have been useful in increasing the self-determination component of QoL-by indirectly catering to some EF domains. Participants in study did report that the program was beneficial.

Caution needs to be applied with results as there were several limitations to study's generalizability and strength of finding. Moreover, it would have also been useful to measure personal development component of QoL and other such domains. Past literature does suggest that compared to regulation with emotions and behaviour, this population tends to suffer in other areas of EF (Smith-Spark et al., 2016)-which was not sufficiently addressed by program.

4.6 Summary

It is apparent that research into LSBE programs tailored towards ND adults is still at its infancy, despite several reported benefits. No program evaluated in this review statistically compared outcomes to typical population, but rather implies its relevance (i.e., how our target population tend to face greater barriers to full participation in various life domains compared to typical peers). Many of these studies have acknowledged explored this as a result of ableism, lack of accommodation, and bias social structures which too often favour neurotypicals (Jonsson et al., 2019). Furthermore, most of the programs we found were tailored towards adults with ASD and ADHD, with limited exploration into adults with learning difficulties or comorbid types of NDs. Inclusion, diversity, and human rights issues were also evident when critically analyzing the findings.

Given the growing need of reliable services for ND adults, LSBE programs have the potential to

provide promising outcomes (Nadig et al., 2018). Since most LSBE programs use multimodal, inclusive approaches, it addresses issues in an practical, time and cost effective manner (Hartung et al., 2020). Moreover, unlike other treatment approaches that focus on the medical model, inclusive services address the issue as a problem within our society. Take, for instance, the flow on effect that LSBE programs have on increasing employment outcomes (Baker-Ericzén et al., 2018; Ward & Esposito, 2019). This approach not only benefits ND individuals, but society as a whole (Jacob, Scott, Falkmer, & Falkmer, 2015).

"It could be concluded that enhancing the opportunities for adults with ASD to join the workforce is beneficial from a societal perspective, not only from an inclusiveness viewpoint, but also from a strict economic standpoint." (Jacob et al., 2015, p. 39).

The general outcome that can be concluded from this review is the potential LSBE has in improving EF, and consequently QoL for ND adults. It allows for our target population to reach a fairer playing field in several areas of daily living-alongside their typical peers, and even those with other NDs that have more accessible support. Furthermore, LSBE has the potential to bridging the gap between an "us vs them" narrative, by catering to the struggles most adults face, in an inclusive manner. Henceforth, LSBE programs tend to appeal to a variety of stakeholders who can all benefit from this structure (Hartung et al., 2020).

5. Recommendations

We authors have proposed the following recommendations based on limitations that have been reported in reviewed papers, and critically analysis of these papers through the lens of our conceptual perspective. Implications for policy, research, and development in this area have been discussed:

5.1 Re-Evaluating Neurodiversity Research and Practice by Increasing Societal Awareness

5.1. 1 Employ More Neurodivergent Researchers

Neurodivergent voices need to have greater relevance to the broader research a gender around the understanding of their challenges (van den Bosch et al., 2019). New research policies need to encompass the "nothing about us without us" more readily, rather than simply acknowledging its existence- as ND researchers often have remarkable expertise in this field (Fletcher-Watson et al., 2018; Gillespie-Lynch, Kapp, Brooks, Pickens, & Schwartzman, 2017; Milton, 2014). By doing so, research in this area can finally measure up the United Nations Convention on the Rights of Persons with Disabilities (CRPD: UN, 2006) where it is currently, clearly lacking (Callus & Camilleri Zahra, 2017; van den Bosch et al., 2019). Do a cost-benefit analysis and evaluate how research funding can better be allocating in the long run, where the medical model clearly fails (Johnson, 2011; Kirkham, 2017; Kvaale, Haslam, & Gottdiener, 2013). Make sure this is done in a measurable way, to establish change is conducted with tangibility and transparency.

5.1.2 Deconstruct Ableist, Sexist and Racist Research/Theories

In general, a lot of scientific research has held both racial gender bias which has often led to implying

erroneous findings and claims with little evidence to back it up (Beery & Zucker, 2011; Dotson & Duarte, 2020; Helmer et al., 2017; Roberts, Bareket-Shavit, Dollins, Goldie, & Mortenson, 2020; Rogers, 2010; Snowden, 2003). Thus, it is understandable why discriminatory practices exist in field of ND, which is reflective of the unrepresentative sample demographic seen in several programs (as reported in Table 3). When recruiting participants, future research should be mindful in using tools that hold such bias and try and formulate measurements that detect ND more inclusively (Murray et al., 2017). Greater understanding of how people with ND's present across genders, race, cultures, and other spheres is clearly warranted (Maney, 2016; Rogers, 2010; Teufel & Fletcher, 2016).

In the ASD literature, it is evident that many of these gender bias theories exist at greater rates than with ADHD and learning difficulty literature (Baron-Cohen et al., 2011; Krahn & Fenton, 2012). This could be the reason why higher rates of participant diversity is seen in LSBE programs for people in ADHD programs compared to ASD ones. For instance with the -often over-sighted- neuro-sexist 'male-brain' theories of autism (Krahn & Fenton, 2012) . It states that 76.6% of females with ASD have male brains, and ASD is more of a "male disorder" (Baron-Cohen et al., 2011). Oransky (2019), years later, reported that this study had to be retracted due to research errors acknowledged by the researchers themselves. The findings were, in fact, the complete opposite. Moreover, rates of misdiagnosed and undiagnosed females with ASD/ADHD remain extremely high (Quinn & Madhoo, 2014).With more social awareness, and better diagnostic tools, people from diverse backgrounds can be recognised and recruiting for these LSBE programs.

5.1.3 Fund the Under-Researched Population

As evident in our findings, most research has been tailored towards those with just ASD, and sometimes ADHD, whilst little explores those with complex NDs (combined types) and/or learning difficulties. This is not to take away from the fact that ASD research needs to be conducted more appropriately, but there still requires more recognition for ADHD and learning difficulty research in general.

5.1.4 Fund Research for Adults with ADHD and Combined ASD/ADHD Type

Reasons for a lack of funding may revolve around: (a) the negative attitude's surroundings ADHD amongst professionals, academic and society (Fuermaier et al., 2012; Mulholland, 2017), and (b) scarcity in data regarding people with ADHD- as reported by the Victorian Government Department of Education (2007). Of the limited data that is available in however, it is reported that students with ASD/ADHD combined type are the most vulnerable to full, meaningful participation than those with or without other disabilities (Elias & White, 2018; Mulholland, 2017). A submission to address the data, and higher educational problem was made to the Royal Commission in Victoria-indicated evidence of the ongoing issue (Holmes, 2019). In addition, we recommend that health professionals in this field are made more aware of how ASD/ADHD can often coexist and possible formulate new diagnostic tools to detect this co-occurrence.

5.1.5 Fund Research for Adults with Specific Learning Difficulties (SLD)

Despite clear evidence that learning difficulties persist into adulthood (Gerber, 2011), there is a general lack of research conducted in this area. In our review only one program existed. This highlights how little services cater to and recognise this population. As mentioned by Taymans and Kosaraju (2012), there still remains a disagreement on how to even define SLD. Without addressing the roots of the problem, by funding more research in this area to understanding specific learning difficulties, progression in the field will continue to be minimal (Kohli, Sharma, & Padhy, 2018).

Clearly, there is substantial variability and disagreement among professionals about the definition of SLD. Even though the label of SLD has been recognized since the 1960s, it is a disability construct that is still being formed and refined. Clearly, there is substantial variability and disagreement among professionals about the definition of SLD. Even though the label of SLD has been recognized since the 1960s, it is a disability construct that is still being formed and refined.

Furthermore, much like with ADHD research, studies into adults with learning difficulties have consistently noted how challenges tend to represent in the educational settings(McDowell, 2018; Taymans & Kosaraju, 2012). Thus, it could be beneficial to create more awareness in university and education settings around this issue- to bring our understanding to a greater forefront. In our review it was also noted that the only program that did cater to learning difficulties was of low quality. As such, very little can be concluded in this area without conducted larger scale research.

5.1.6 Outcome Specific to LSBE Programs for Neurodivergent Adults

A common limitation reported in almost all LSBE programs was small the same size, which can be by addressed by targeting the above points. Through increasing diversity, and decreasing gender, ethnic and racial bias, key limitations especially evident in ASD programs may be addressed. As described above, the problem is incredibly deep rooted and reflects the issue we have in both our society and academia at large. Yet, by increasing sample size and participant diversity, a plethora of benefits will be evident such as: providing generalizability and represent ability of findings, with greater statistical potential and validity. More robust research designs can be implemented as size of population increases (such as RCT trials and larger scale studies), allowing for services to take on this model with greater confidence (Hartung et al., 2020; Morgensterns et al., 2016). Moreover, LSBE has the potential to reach global heights, whilst accommodating several of its users using: online or face-to-face methods, individual and/or group formats, and embracing the potential of Virtual Reality (VR) (Ward & Esposito, 2019).

5.2 Advertise LSBE Broadly to All Neurotypes

Since this area of research is at its infancy, it may be beneficial to advertise the LSBE to all neurotypes, whilst still acknowledging the unique challenges of ND adults. It could be a good step to increasing awareness of the potential such programs can bring, and ultimately lead to greater government funding in this area. It may also help bridge the gaps between the “us” vs “them” narrative, by showcasing the true powers of inclusive practice.

5.2.1 Example and Evidence

In Adelaide, Australia, City of Onkaparinga Council has advertised LSBE program for adults (Slessor, 2019). The director of the program reported that responses to the program had been overwhelming- as places filled up just within two days. Moreover, eight undergraduate students -from a thematic, qualitative study-felt strongly about the importance and efficacy of LSBE programs being taught to them (Nair & Fahimirad, 2019). It could even allow for more productive discussions around how our social structures (Ito, 2018), and notion of normality (Freud, 1999), limit all of us in some shape or form. Further scientific exploration into this area may be beneficial.

6. Conclusion

Although some LSBE programs for ND individuals do exist in residential settings (Kingsnorth, Rudzik, King, & McPherson, 2019), and in some schools (McPherson et al., 2018), little -if any- exist for ND adults who are school leavers (Camm-Crosbie et al., 2018; Pinder-Amaker, 2014), job seekers (Hedley et al., 2016) or those who 'slip through the cracks' to general to service access. Often the biggest barrier is around the misconception that ND adults will learn these skills on their own-despite years of evidence suggesting otherwise (Cronin, 1996). For instance, Taylor and Seltzer (2011) finds that autistic individuals have worse employment outcomes than both the typical population, and even other disabilities such as intellectual (ID).

Criticisms of the current education system suggests that too much emphasis is being placed on cognitive and vocational skills opposed to psychosocial ones (Prajapati, Sharma, & Sharma, 2016). Although the Dolores framework is still used in the 21st century, reforms are needed in to context of education and employment to address this issue (Olaniran, 2016; van Laar, van Deursen, van Dijk, & de Haan, 2020). Formal education is important, but a review of the literature suggests that teaching life skills can help bridge the gaps between basic functioning and thriving in life, especially for the ND population (Prajapati, 2016).

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ppendix A

Peg Dawson and Richard Guare Executive Function Model. Adapted from Dawson and Guare's "Smart but Scattered Mind" (2016, p.40)

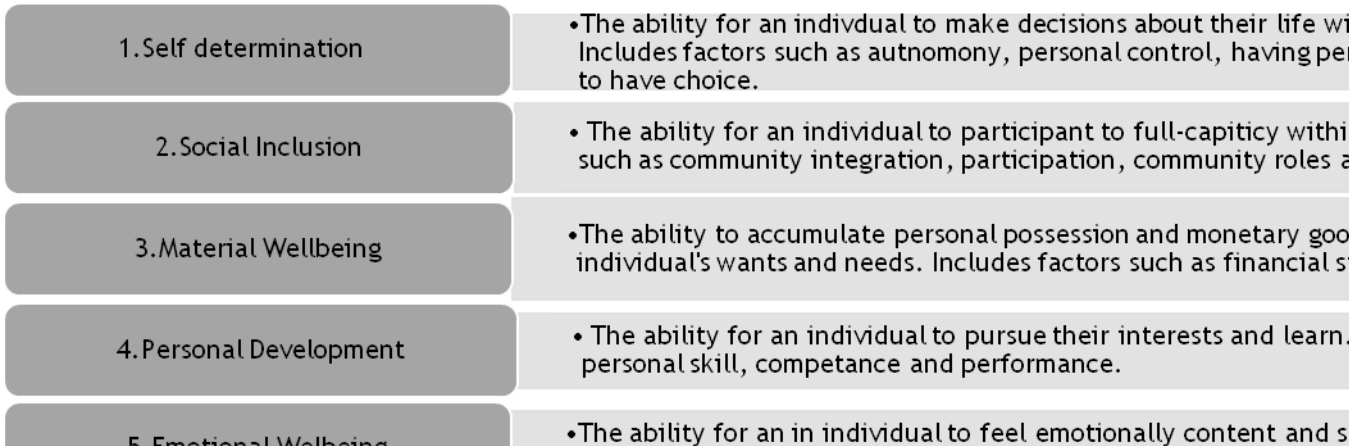
1. Response Inhibition	•A multifactorial construct which describes the ability for one to supress undesired impulses on a goal-specific task
2. Working Memory	• A multicomponent system in the brain which helps to hold and execute complex cognitive tasks
3. Emotional Control	•An aspect of emotional regulation which describes to the ability emotions in order to control behaviour, and complete tasks
4. Sustained Attention	• Ability to focus on goal-specific tasks without distractions, fatig desired oucome
5. Planning/prioritising	•Ability to create the steps needed to completing a goal, and lear based on importance
6. Organisation	•Abiltity to effectivly gather and structure information towards a
7. Time management	•Ability to estimate, allocate and assign limits and deadines to go • tasks
8. Flexibility	•Ability to adapt well to change and unconscious shift attention shifting/concept formation which focuses on the adpting to cha through analysis of stimuli. In contrast, set switchching is the ab effectively respond to change demand.
9. Metacognition	•Ability to self reflect and monitior ones own thoughts and behav
10. Goal-directed persistence	•Ability, and drive to create and comitte to goal, whilst not being
11. Stress tolerance	•Ability to overcome or manage adversity, uncertantity and char
12. Fluencey	•Ability to produce verbal and non-verbal stimuli such as ideas, d commonly studied fluency is verbal fluency.

Note. This model is based off the corresponding EF questionnaire with 36 items across a 7-Likert Scale. The advantages of this model are that it assesses both an individuals' strengths, and weaknesses of EF. Moreover, it has been widely used in literature specific towards the ND population- including adults. Research recognizes the adverse outcomes of executive dysfunction on various QoL domains such as: academic and occupational success, personal management and social functioning (Holst & Thorell, 2020).

This is clearly indicated in Figure 2 using an established, inclusive model.

Whilst Figure 2 outlines comprehensive psychosocial factors, various levels of discrimination, including social attitudes, are often overlooked (Angermeyer & Matschinger, 2003; Fuermaier et al., 2012; Progler, 2009). For example, constant, negative feedback towards ND children can adversely impact EF in adulthood (Luca & Leventer, 2011; Lücke, Lam, Müller, & Philipsen, 2017). Nonetheless, these skills can be learnt, and may also improve academic performance for students in higher education. In fact, Jacob & Parkinson (2015)'s meta-analysis found a causal link between EF and academic success when taught in schools-based interventions.

8 Core Quality of Life (QofL) Domains. Adapted from (Schalock, 2000).



Note. This model in based off the social model of disability, and therefore has its roots in the principles of neurodiversity (Robertson, 2009)

Appendix B

Key Terminology

Neurodiversity is a biological fact that should not -yet often is- confused with the social movement that stems from this (Dyck, 2020). Essentially, a neologism that attempts to encapsulate, and betterment the narratives surrounding neurological brain differences (Fenton & Krahn, 2007; Graby, 2015; Happé & Frith, 2020). Its coinage dates back to the 1990's, after Judy Singer -an Australian sociologist on the autism spectrum- used it in her Honours thesis to address autistic people (Arnold, 2017). In a literal sense, she merged the terms "neurological brain diversity" into one- "neurodiversity". The word initially gained traction amongst the autism community and became particularly popular with self-advocates across various internet forums (Zolyomi, 2017). Subsequently, people with other neurodevelopment differences such as ADHD, Dyslexia, Dyspraxia, comorbidities, and other mental health challenges began to resonate with the concept (Graby, 2015; Baron-Cohen, 2017). This helped build upon a sense of community amongst marginalised individuals (Wright, 2016).

Theneurodiverse paradigm is a model that attempts to reappropriate pathologized, and medicalised narratives with more inclusive ones (Craine, 2020). Essentially, viewing neurodiversity akin to gender, sexual and racial diversity. The objective of the neurodiverse paradigm is to address the gaps, and

pitfalls of biomedical and medicalized perspectives in par with calls for reform to age-old practises (Deacon, 2013; Lake, 2017; The, 2013).

People with psychiatric labels, or disability labels often prefer to be described as **"neurodivergent" (ND)** or having a **"neurodivergence".** For example, people with neurodevelopmental disorders (e.g., ASD, ADHD and Dyslexia), disabilities (e.g., Cerebral Palsy) acquired neurodiversities (e.g., Traumatic Brain Injury), mental illness (e.g., Borderline Personality Disorder, C-PTSD) or comorbidities (e.g., ASD with C-PTSD) may all identity as neurodiverse. This is often because negative connotations attached towards may psychiatric and disability labels exist, often leading to the re-stigmatisation and marginalisation of already marginalised individuals (Gillespie-Lynch, 2017). Alternative language -like that pertaining to neurodiversity- is all-inclusive, and helps dispel myths birthed of injustices (Fenton, 2007).

Neurotypical (NT), on the other hand, is a label that describes those who do not display characteristics of autism or another neurodivergence (Tan, 2018). The term attempts to address the pitfalls of using 'us vs them' narratives, and notions of 'normal is superior'. This term is sometimes used in research, but more so satirically by neurodivergent advocates (Brownlow, 2010).

Neurotype is, for the most part, is non-dichotomous, and used to refer to a particular group of individuals who share similar brain structures and/or functioning (Jollans & Whelan, 2018). Essentially, the blending of the words "neurological type", per "neurotype" can mean either/both neurodiverse and neurotypical. Several self-advocates have argued -in accordance with social theories of disability- that society is designed in favour of the NT neurotype (Botha & Frost, 2018; Brownlow & O'Dell, 2009; Clark et al., 2019) Consequently, the strengths of other neurotypes are not sufficiently catered to and well understood (Alkhaldi, Sheppard, & Mitchell, 2019; Broderick & Ne'eman, 2008; Happé & Frith, 2020; Parish-Morris, 2019; Richards et al., 2019). Some, such as self-advocate Swan (2020), argue the that the NT neurotype may, in fact, just comprise of a loud minority of individuals who have had the upper hand (Camm-Crosbie, Bradley, Shaw, Baron-Cohen, & Cassidy, 2018; Carpiniello & Pinna, 2017; Cassidy et al., 2019; Fitzpatrick & River, 2017; Kirby et al., 2019; Moscovici, 1991; Qureshi, Schofield, Maneta, & Coffey, 2014).

The neurodiverse movement is a social justice movement founded on principles pertaining to the social model of disability. It advocates for the civil and political rights, equality, respect, and full societal inclusion of neurodivergent individuals (Graby, 2015; Dyck, 2020; Arnold, 2017). The movement can be incredibly advantageous to making positive, progressive changes in various spheres of society (Nicolaidis, 2012; Graby, 2015). Nonetheless, like many other social movements, the neurodiverse movement has been fraught with some criticism and debate (Ortega, 2009). This is often due to the understanding of neurodiversity taken out of context and misconstrued for what it truly intends to represent (Ortega, 2009; Houting, 2018).

Life Skills have been widely defined by various stakeholders and policy makers over the years due to their multidimensional and dynamic nature (Behera, 2015). As noted by Singh (2003), its application

translates across various situations (e.g., education, workplace, home, community, formal and informal settings), and domains of human existence (e.g., health, environment, gender, politics, culture, lifespan). Due to such complexities and context-driven variables, there remains no one universally accepted definition and use for the term (Jones & Parker, 2014). However, common themes or elements can be observed and articulated in line with the topic of our literature review.

We authors feel the definition most suited to capture the essence of life skills is from The World Health Organization (WHO 1999, p. 1): "the abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life". Specifically, WHO lists 10 "life skills" pertaining to psychosocial competencies, and encompassing some important elements (Behera, 2015). Namely: self-awareness, critical thinking, problem solving, creative thinking, decision-making, interpersonal relationship, empathy, effective communication, coping with stress, and coping with emotions (WHO, 1999, p.3).

In addition to the WHO definitions, and in relation to the context of neurodiversity and adulthood, we will integrate Cronin (1996)'s definition into our review:

"life skills are tasks and behaviours needed to allow for the independent functioning of an individuals into adulthood."

The International Bureau of Education (IBE) views life skills as assets that can strengthen the personal management, and social skills needed for daily living. It conceptualizes this in par with Delores four pillars of learning—a concept extracted from the 1996 Delores Report (Olaniran, 2016). Developments of the Delores report with Dolores four pillars have had global implications, with the use of life skill integrated in schools and adult curriculum worldwide.

For context, the Delores four pillars was created by the Delores Commission, who laid the foundations to, and influenced global policies around the educational system using humanistic approaches (Tawil & Locatelli, 2015). The framework essentially comprised of: knowledge and critical thinking skills (learning to know), practical skills (learning to do), personal skills (learning to be) and social skills (learning to live together) (Behera, 2015). The psycho-social life skills fall under learning: to know, to be and to live together.

Life Skills Based Education (LSBE) is an approach that aims to cultivate life skills through evidence -driven, skill-based, learner-focused interventions that use practical and interactive methods to learning (UNICEF, 2003).

The World Health Organisation's (WHO) Department of Mental Health state that LSBE should ideally be:

"designed to facilitate the practice and reinforcement of psychosocial skills in a culturally and developmentally appropriate way; it contributes to the promotion of personal and social development, the prevention of health and social problems, and the protection of human rights" (1999, p.3).

Cronin (1996) systematic literature review, reveals that the outcomes of an effective LSBE programs can be measured by:

"analysing an individuals' level of enhanced community adjustment, independent functioning and quality of life" (1996, p.53).

Life skill training can also provide various mental health benefits that meet the needs of modern society (Jamali, 2016). As we see deep cultural shifts, and changes in lifestyle, demands for life skill training increase (Gerami, 2015).Integrating digital skill training, and the digitalization of life skill programs can further meet the technological demands of living in the 21st century (van Laar, 2020). Although research acknowledges and reports several benefits of LSBE- a potential lack of research in this area leaves several questions to why, and how it works unanswered (Jones, 2014; Nasheeda, 2018).

The importance of life skills programs for ND adults has historical significance. Cronin (1996)'s systematic review reported the growing need of such services in the 21st century for adults with learning disabilities. Such an example can translate to ND adults as well. A variety of biopsychosocial factors can come into play, which would be fruitful to address by teaching life skills in an inclusive manner (Burke et al., 2019; Pinder-Amaker, 2014)

Service cliff, is a term that reflects the dramatic drop in serves available for ND adults as soon as they reach adulthood (Baker-Ericzén, Brookman-Frazee, & Brodkin, 2018). As stated by Murphy et al., (2016, pp.1)*"while services for children with ASD are relatively well established, service provision for adults with ASD is in its infancy".*