



Neurodiversity in higher education: a narrative synthesis

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Abstract

Neurodiversity is an umbrella term, including dyspraxia, dyslexia, attention deficit hyperactivity disorder, dyscalculia, autistic spectrum and Tourette syndrome. The increasing number of students with learning difficulties associated with neurodiversity entering higher education (HE) poses a shared and growing challenge internationally for teachers and institutional leaders. This narrative synthesis draws together a corpus of international literature on how neurodiverse students experience higher education and the ways in which higher education institutions respond to the cluster of neurodiverse conditions. A systematic review was carried out to search, retrieve, appraise and synthesize the available evidence to provide an original contribution to the literature and significant insights of worth to higher education internationally. An inclusive approach to data extraction was used to ensure that all the relevant studies were included. All stages of the review process, including the initial search, screening, sample selection and analysis, are described. Three main themes and 11 subthemes were identified. Although the majority of publications focus on either dyslexia, autistic spectrum disorder, or ADHD, some common themes are evident in student experience across learning difficulties associated with neurodiversity. Although support services and technologies are available to meet students' specific needs, there is an apparent dislocation between the two. Fear of stigmatization and labelling worsens the divide between what is needed and what is available to ensure neurodiverse students' success in higher education, where good intentions are evidently not enough.

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Introduction

An increasing number of students with disabilities are progressing into higher education (HE) internationally (Pino and Mortari 2014). As numbers increase, so too does the literature showcasing support strategies and sharing research on how students experience HE. Yet disability comes in many forms. The definition of the United Nations Convention on the Rights of Persons with Disabilities includes ‘those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others’ (UNCRPD 2006, p.4).

This narrative synthesis focuses specifically on intellectual impairment but adopts an alternative, nuanced term of ‘neurodiversity,’ an umbrella term, originally coined in relation to autism, for several conditions traditionally pathologized and associated with a deficit, including dyspraxia, dyslexia, attention deficit hyperactivity disorder, dyscalculia, autistic spectrum and Tourette syndrome (Singer 1999). Commonly acronyms are used.¹

The social model of disability is adopted as a lens for the synthesis. Like the social dynamics resulting from other forms of human diversity, such as ethnicity or gender, which can result in social power inequalities and disadvantage, being disabled by any of these conditions is due, at least in part, to society’s attitudes and actions, rather than to the condition per se. In accordance with the UNCRPD (2006) definition of disability, we recognize that people do have impairments but suggest that as a social construction, academia has the means to instigate changes that mitigate many of the hindrances caused by impairment, which create disability.

Use of the term, neurodiversity, focuses on differences in individual brain function and behavioural traits, regarded as part of normal variation in the population. Terms, such as ‘atypical developmental pathways’ (Kapp et al. 2013) can be challenged by the stance that ‘there is no typical mental capacity – no normal brain to which all others brains are compared’—neurodiversity simply means being ‘wired’ in a different way rather than ‘wrongly’ (Armstrong 2012 p. 11). Notwithstanding the fact that some impairments result in cognitive processing that is problematic and impacts on an individual’s capacities to engage meaningfully with wider society, many neurodiverse conditions bestow talents or benefits. For example, Robertson (2008) highlights strengths and capabilities associated with ASD: preference for structure and consistency, aptitude for repetition and a detailed, sophisticated world understanding. Nevertheless, despite some increased awareness and acceptance of neurodiversity in HE, without a supportive culture and neurodiversity awareness, the focus continues to be on the deficit (Robertson 2008). The extent of the challenge cannot be underestimated. Statistics on the prevalence of neurodiversity in HE are by no means straightforward as they are reliant on self-disclosure, subject to definitional variation and tend to be condition specific. However, prevalence can be extrapolated from general population data.

¹ Common acronyms:

DCDDevelopmental coordination disorder
AD(H)DAttention deficit (hyperactivity) disorder
ASDAutism spectrum disorder
ASAsperger’s syndrome
SpLDsSpecific learning difficulties
LDLearning disabilities

Referring to the most common neurodiverse condition, Knight (2018) claims 5–10% of the global population has dyslexia which is reflected in the HE population. The World Health Organization (WHO) (2019) estimates that 1 in 160 children has ASD worldwide, although prevalence in many low- and middle-income countries is unknown. The influx of students with ASD in HE (Hillier et al., 2018) should not be surprising when despite varying levels of intellectual functioning, from profound impairment to superior levels, average or above average IQ scores (IQ > 85) occur in 44% of people with ASD <https://www.autismspeaks.org/autism-facts-and-figures>

Clearly, neurodiversity should not preclude school leavers progressing into HE, yet Hillier et al. (2018, p. 20) observe that ‘post high-school graduation outcomes remain bleak.’ In some countries, conditions such as dyslexia are not recognized as disabling, whilst in others, they are considered to be a mental disability suggesting that disability is culturally determined. Narrow definitions of disability and/or underreporting can result in highly skewed and unreliable data on prevalence (Sida 2014), lack of identified need for support and therefore no stimulus to be inclusive (Konza 2008). Matthews (2009) argues that although inclusivity is no panacea, anticipating teaching and learning issues eradicates the special needs of some disabled students altogether. This narrative synthesis aims to explore the current state of awareness, attitudes and responses of staff to the needs of neurodiverse students and how they experience contemporary HE.

Method

Rodgers et al. (2009) suggest making sense of large bodies of evidence, adopting a range of research methods, is a challenge that narrative synthesis addresses to add to a body of knowledge rather than simply summarizing research findings. Thus, we have aimed to integrate relevant literature to provide an original synthesis that is greater than the sum of the parts (Weed 2005), identifying themes that have breadth of significance across specific conditions classed as neurodiverse and across cultures. Syntheses are conducted in response to particular research questions, in this case:

1. What is the experience of neurodiverse students in contemporary HE?
2. How does HE respond to neurodiversity?
3. What strategies, processes and resources are in place to support success?

Literature search procedure

The initial literature search included electronic databases: Scopus, Science Direct, British Education Index, ERIC and PsychINFO. The terms ‘higher education’ and ‘college’ were used with Boolean Operator ‘AND’ (but not OR, NOT or AND NOT) in conjunction with neurodiversity, dyspraxia, dyslexia, attention deficit hyperactivity disorder, dyscalculia, autistic spectrum and Tourette syndrome. Variations including ‘autistic’, ‘autism’, ‘autistic spectrum disorder’, neurodiverse and neurodiversity were included.

The inclusion criteria comprised: (1) conducted in the HE setting, (2) focusing on neurodiversity and/or learning difficulties, (3) empirical rather than theoretical (4) including a methodology and scientific background, (5) written in English and (5) published between

2008 and 20th May 2019. A PRISMA flowchart (Moher et al. 2009) is used to display the flow of information through different phases of this study (Fig. 1). Identification was based on article titles and key words where available. Screening included reading of abstracts. Following initial screening, full texts were assessed against inclusion criteria. The final corpus consisted of 48 studies to be included in the narrative synthesis.

Data analysis

The study involved a systematic approach to analysis using narrative synthesis which allows researchers to classify the contents of related studies (Posthuma, Morgeson and Campion 2002). Relevant publications are retrieved, critically appraised, summarized and reconciled regarding a specific research problem (Petticrew and Roberts 2006). The approach to data extraction was inclusive rather than selective (Pino and Mortari 2014) to ensure that all relevant findings were included. The findings and/or results sections of the selected studies, were read critically by one researcher (MK) against the research questions. Findings were then subjected to thematic analysis to determine recurring themes (Braun and Clarke 2006; Pino and Mortari 2014) using the following steps: (1) texts were read repeatedly, (2) relevant units of meaning were identified, (3) all units were labelled with descriptive codes, (4) codes were grouped into themes and (5) themes were grouped under main themes. Since similar themes were named

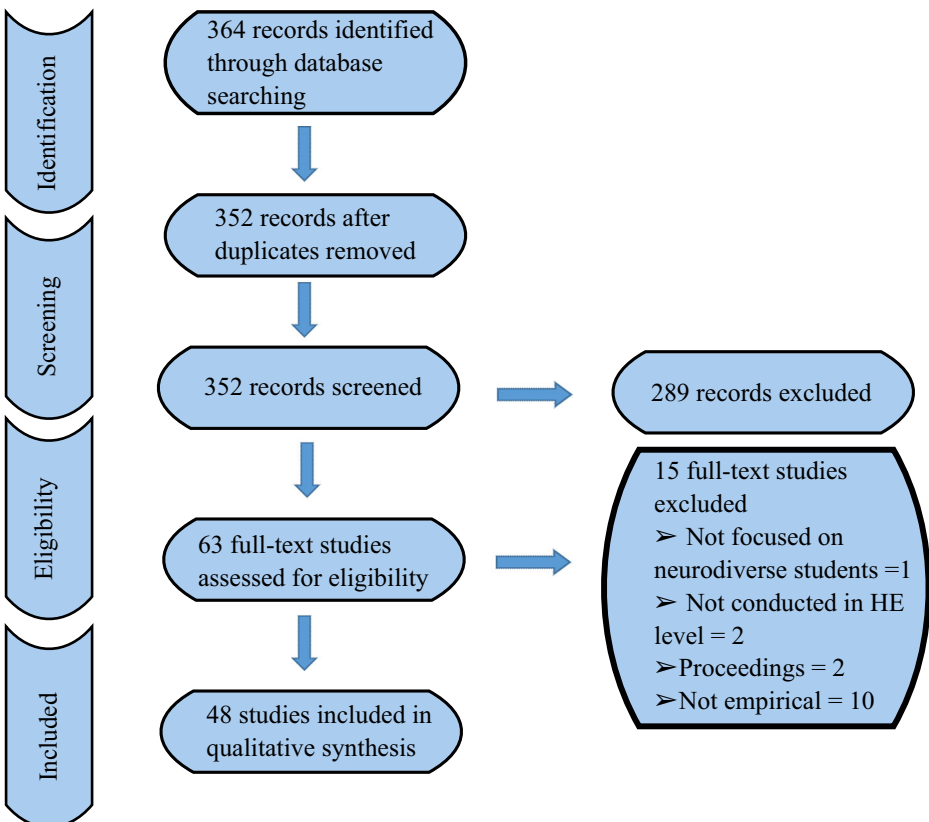


Fig. 1 PRISMA flowchart

Table 1 Summary of thematic analysis

Main themes	Subthemes	Studies supporting each subtheme ^a
The experience of neurodiverse students in contemporary higher education	Emotional reactions and wellbeing	1; 10; 12; 14; 13; 21; 22; 24; 25; 27; 30; 31; 35; 36; 43; 44.
	Personal and social life	1; 4; 5; 13; 23; 24; 25; 27; 28; 29; 30; 31; 35; 36; 44.
	Academic life	2; 9; 10; 12; 18; 20; 21; 23; 24; 25; 30; 37; 39; 42.
	Identity and possible selves	8; 11; 13; 14; 16; 21; 31; 35; 43; 40.
Higher education's response to neurodiversity	Disclosure and diagnosis	6; 18; 19; 25; 27; 30; 35; 36; 37; 38; 41.
	Reasonable adjustments	2; 5; 9; 14; 16; 36; 48.
	Academic attitudes and expectations	1; 12; 13; 15; 17; 20; 23; 25; 27; 30; 31; 38.
Teaching, learning and assessment strategies	Institutional support and pastoral care	1; 7; 9; 12; 14; 15; 16; 17; 18; 19; 21; 22; 25; 26; 27; 28; 29; 30; 33; 34; 35; 36; 37; 38
	Teaching and learning approaches	14; 15; 17; 20; 22; 26; 27; 29; 30; 33; 34; 36; 37; 46; 47.
	Technological support	2; 3; 7; 9; 10; 12; 16; 19; 20; 30; 32; 39; 45.
	Assessment approaches	2; 13; 16; 19; 23; 30; 36; 47.

^a The numbers in this column refers to the label numbers of the studies in Table 2, and each study is referred to by its reference number within the results section

Table 2 Description of the studies included in the thematic analysis ($N = 48$)

References and label numbers	Country of origin	Sample	Methodology	Neurodiverse conditions	Key findings/recommendations
1. Griffin and Pollak (2009)	UK	27 current and former students	Qualitative (interviews)	Dyslexia, dyspraxia, ADHD, Asperger, dyscalculia	Students experienced frustrations, and negative experiences, with peers and teachers. Consistent support and quality of social relationships helped cope with difficulties.
2. Sarrett (2018)	USA	Current or former students	Mixed design (survey; focus group interviews)	ASD	UDL practices flexible assignment dates/formats, optional group work, and clear instructions provided in multiple formats. Students experienced inconsistent implementation and difficulty obtaining adjustments. Support neglected sensory and social needs.
3. Everhart and Escobar (2018)	USA	2 students	Qualitative (ethnography)	ASD	Large icons helped students navigate the library's website. Signage, library staff, computer cues, and previous knowledge helped physical navigation.
4. Missiuna et al. (2008)	Canada	9 students	Qualitative (interviews)	Dyspraxia	Poor motor skills resulted in social isolation.
5. Kirby, Stigden, Beveridge, and Edwards (2008)	UK	79 students with dyslexia and/or dyspraxia	Mixed design	Dyslexia; dyspraxia	Students received similar support. Lack of assessment training for academics and problems with processes created barriers for dyspraxic students.
6. Ryder and Norwich (2018)	UK	118 assessors	Mixed design (interviews; questionnaire)	Dyslexia	Assessors focused on discrepancy were sceptical about validity of psychometric tests and favoured professional observation and experience over test results.
7. Dobson (2018)	UK	11 HE websites	Qualitative (content analysis)	Dyslexia	Only three HEIs offered all services needed for dyslexic students. Despite availability of IT equipment, ease of access was unclear.
8. Loveland-Armour (2018)	UK	8 students	Qualitative (case study)	Dyslexia	Students associated with a dyslexic identity following different routes to diagnostic assessment.

Table 2 (continued)

References and label numbers	Country of origin	Sample	Methodology	Neurodiverse conditions	Key findings/recommendations
9. MacCullagh, Bosanquet, and Badcock (2017)	Australia	13 students with dyslexia; 20 non-dyslexic peers	Qualitative (interviews)	Dyslexia	Taking lecture notes and reading journal articles were difficult. Students appreciated face-to-face lectures and PowerPoint slides although sometimes difficult to follow. UDL practices, e.g. lecture capture, supported student attainment.
10. Nightingale et al. (2019)	UK	42 dyslexic students; control group 50 students	Mixed experimental design	Dyslexia, LD	Occupational potential was highly influenced by social surroundings, resilience and agency of students and their families.
11. Murphy and Stevenson (2019)	UK	9 masters' students	Qualitative (interviews)	Dyslexia	Varied types and sources of support buffered college-related stress and facilitated academic success. UDL was poorly understood by academic staff. .
12. Smith (2017)	USA	10 students	Qualitative (case study)	Dyslexia	Experiences of helplessness and hopelessness were common. Students feared stigmatization, felt inadequate, poorly understood and supported.
13. Shaw and Anderson (2018)	UK	8 junior doctors	Qualitative (interviews)	Dyslexia	Self-knowledge, motivation, advocacy, and academic skills overcame barriers to learning. A combination of instructional strategies, UDL and social learning helped student achievement.
14. Cipolla (2018)	USA	8 students	Qualitative (interviews)	Dyslexia	Students benefitted from sharing placement experiences, supportive placement mentors, and HEI staff with dyslexia knowledge.
15. Child and Langford (2011)	UK	12 student nurses, 6 with dyslexia and 6 without	Qualitative (interviews)	Dyslexia	Staff efforts to understand and manage the impact of dyslexia promoted students' self-efficacy and confidence.
16. Holgate (2015)	UK	30 students	Qualitative (interviews)	Dyslexia	Attitudes to UD initiatives were mixed. Increased flexibility and breadth of awareness was needed. Informal networks
17. Couzens et al. (2015)	Australia and Japan	7 students; 8 support staff	Qualitative case study (interviews)	Learning disabilities (Dyslexia, ADHD, dyspraxia, Asperger's syndrome, ASD)	

Table 2 (continued)

References and label numbers	Country of origin	Sample	Methodology	Neurodiverse conditions	Key findings/recommendations
18. Wennås Brante (2013)	Norway	7 current or former students	Qualitative (interviews)	Dyslexia	and caring and flexible lecturers were important. Students' main strategy for overcoming dyslexia was investing time in study. Parental support was important.
19. Taylor et al. (2016)	UK	Range of disabilities	Qualitative (case study; documentary analysis)	Multiple disabilities	Adjustments included non-medical helpers; dyslexia screening; enhanced library services, access to printers/scanners, assistive software support; special examination provision.
20. Glazzard, and Dale (2015)	UK	A lecturer in initial teacher training	Qualitative (interviews)	Dyslexia	Dyslexic student teacher experienced marginalization. Technology was helpful.
21. Hadley, (2017)	USA	A student with multiple learning disabilities	Qualitative	Multiple LD (dyslexia, dysgraphia, ADHD)	Students struggled with the skill sets needed to complete tasks. Tutors helped shape and present ideas.
22. Flowers (2012)	USA	10 students	Qualitative (case study; interviews)	ADHD	Institutional agency and social capital influenced outcomes of ADHD students. Parents, peers, teachers, counsellors played supportive roles.
23. Jansen et al. (2017)	Belgium	43 ASD students, 30 counsellors 43 students without disability	Quantitative (questionnaire)	ASD	Selecting and implementing adjustments, within a UD approach, depended on personal and environmental characteristics.
24. Kwon, Kim, and Kwak (2018)	South Korea	12 students	Qualitative (interviews)	ADHD	Students struggled with negative thoughts, poor self-esteem, irregular lifestyles due to poor time management, dissatisfaction with academic performance and interpersonal relationships.
25. Bolourian, Zedyk, and Blacher (2018)	USA	13 students with ASD; 18 students with ADHD	Qualitative (interviews)	ASD; ADHD	University led to social, emotional, and academic challenges.
26. DuPaul et al. (2017A)	USA	1782 students	Quantitative (hierarchical linear modelling)	ADHD; LD	Coaching and tutoring helped students with ADHD to obtain greatest gains in GPA.

Table 2 (continued)

References and label numbers	Country of origin	Sample	Methodology	Neurodiverse conditions	Key findings/recommendations
27. DuPaul et al. (2017B)	USA	Students with ADHD ($n = 5511$), LD ($n = 2626$), ADHD + LD ($n = 1399$), or neither disability ($n = 5737$)	Quantitative (MANCOVA)	ADHD; LD	Students entered college with low competencies, especially conscientiousness, and self-evaluation of academic and psychosocial functioning. Impairment stabilized for students with ADHD attending college. Parental involvement decreased overall impairment.
28. Howard et al. (2016)	Canada and the USA	806 students	Quantitative (multilevel growth model)	ADHD	
29. Barnhill (2016)	USA	30 HEIs	Qualitative (interviews)	Asperger's syndrome (AS)	Students required an individualized, comprehensive and flexible approach. Discomfort using supports or disclosing disability meant less support and poorer overall experience. A UDL teaching framework, emphasizing strengths, would reduce reliance on supports and avoid disclosure.
30. Anderson, Carter, and Stephenson (2018)	Australia	48 students	Quantitative	ASD	Students' challenges included perceived sense of difference, social interactions, managing change and independence.
31. Vincent et al. (2017)	UK	'Neurotypical' academic facilitator; 7 student co-researchers	Qualitative (participatory action research; systematic inquiry)	ASD	Computer-mediated communication allowed students to actively participate in teamwork.
32. McDowell (2015)	UK	4 students including 1 student with AS	Qualitative (case-study)	Asperger's syndrome (AS)	Students practiced self-advocacy and experienced shared empathy and skill development.
33. Hotez et al. (2018)	USA	Students as mentors, mentees, facilitators	Mixed method (survey; interviews)	ASD	The participatory process helped to meet students' needs, acknowledge and validate their emotions and fulfil their aims.
34. White et al. (2017)	USA	26 students; parents	Mixed method (survey; interviews)	ASD	Students and their parents confronted challenges together but experienced relationship tensions.
35. Van Hees, Roeyers, and De Mol (2018)	Belgium	34 students with ASD, and parents	Qualitative (interviews)	ASD	

Table 2 (continued)

References and label numbers	Country of origin	Sample	Methodology	Neurodiverse conditions	Key findings/recommendations
36. Van Hees, Moyson, and Roeyers (2015)	Belgium	23 students	Qualitative (interviews)	ASD	Students faced daily difficulties with new situations which impacted on wellbeing.
37. Berry (2018)	USA	7 students	Qualitative (interviews)	ASD	UD principles advocated: customized services, peer mentors, involving parents, fostering a disability-friendly environment. Findings advocated social inclusion, entitlement to education, and equality of opportunity.
38. Hadjidakou and Dimitra (2008)	Cyprus	Students ($n = 10$), tutors ($n = 4$), heads of HEIs ($n = 10$)	Qualitative (interviews; focus group discussions)	Dyslexia; physical disabilities	
39. Hillier et al. (2018)	USA	52 students	Mixed design (pre-post surveys; interviews)	ASD	Support groups helped reduce loneliness and anxiety and increased self-esteem. UD strategies included flexible teaching approaches, digitally accessible materials, intuitive grading rubrics/syllabi, and technology including specialized programs, apps, personal digital assistants, electronic organizers.
40. Shattuck et al. (2014)	USA	120 Students	Quantitative (secondary data analysis)	ASD	Some students did not consider themselves to be disabled making them ineligible for support. Creating services to support social and academic success for all students without requiring students to 'out' themselves would decrease stigma.
41. Someki et al. (2018)	USA and Japan	Students—Japan ($n = 212$); US ($n = 365$)	Quantitative (pre-post surveys)	ASD	Stigma associated with autism was culturally related to the desire to conform to societal norms.
42. Kirby et al. (2008)	Canada	Students with ($n = 36$) and without ($n = 66$) dyslexia	Quantitative (performance tests; surveys)	Dyslexia	Dyslexic students reported significantly greater use of study aids, time management strategies and deeper approach to learning compared to students without dyslexia.
	USA	321 Students		ADHD	

Table 2 (continued)

References and label numbers	Country of origin	Sample	Methodology	Neurodiverse conditions	Key findings/recommendations
43. Norwalk, Norvilitis, and MacLean (2009)	USA	15 students	Quantitative (surveys; achievement scores)	ADHD	Higher levels of ADHD symptoms were related to lower levels of career decision-making self-efficacy, academic adjustment, study skills, and GPA. Loss of parental supervision and structure, variable course schedules and distractions of campus life led to health-risk behaviours.
44. Meaux, Green, and Broussard (2009)	Norway	12 current or former students	Qualitative (interviews)	Dyslexia	Students experienced challenges associated with VLE use, including information overload, imperfect word processing tools, inadequate search functions, and using more than one system at a time.
46. Prevatt and Yelland (2015)	USA	148 students	Experimental design	ADHD	Coaching combining cognitive-behavioural therapy with psychoeducational techniques had positive impact.
47. Lewandowski, Gathje, Lovett, and Gordon (2013)	USA	Students with ($n = 35$) and without ($n = 185$) ADHD	Quantitative (performance tests; surveys)	ADHD	Students receiving extended time to complete high-stakes exams performed similarly to peers. UD (i.e. developing tests allowing greater access to all) is fairer.
48. Chew, Jensen, and Rosén (2009)	USA	196 students	Quantitative (surveys)	ADHD	Half of students received adequate accommodations, but only half of those reported actually using them.

differently in different studies, efforts were made to reconcile the themes using an integrative approach (Barnett-Page and Thomas 2009; Parry and Land 2013). Finally, the identified themes were summarized descriptively under the thematic headings using narrative synthesis.

The research questions provided an a priori framework of three main themes. The narrative analysis gave rise to 11 subthemes. In this analysis, an article could be coded under multiple themes. The final corpus of studies is shown in Table 1. The numbers in Table 1 are cross-referenced to Table 2.

Results

The researchers identified 48 relevant studies and analysed them to produce the summary displayed in Table 2. The majority of studies were conducted by scholars from the USA (22) and the UK (14) and published as research articles (44) or doctoral dissertations (4). Research samples mostly comprised current and/or former HE students (41). The remaining studies featured HE students and their parents (2), or HE students, and academic or technical support staff (5). One study focused on analysing higher education institution (HEI) websites. Studies using a qualitative research design were in the majority (29), but mixed methods (7), experimental (1) and quantitative studies (11) were included. Dyslexia (18), autism spectrum disorder (ASD) (14) and ADHD (12) studies were most common, with fewer studies examining all types of neurodiversity (6), dyspraxia (2), Asperger's syndrome (AS) (2) and dysgraphia (1).

The experience of neurodiverse students in contemporary HE

Emotional reactions and wellbeing: Most students with learning disabilities experience frustrations due to negative university experiences, especially if the necessary learning tools are not readily available (21). Leaving behind familiar structures, people and environments to face challenging situations such as variable course schedules is frightening (36; 44), and students can feel isolated, alone, stressed, anxious, unhappy, tired, depressed and overwhelmed (1). Dyslexic students experience helplessness and hopelessness as a result of a fear of stigmatization, feelings of inadequacy and a lack of understanding (13); they also have short-term memory problems and often feel too embarrassed to ask questions (10). Stigma in autism has been associated with cultural difference and perceived need to conform to societal norms (41).

Cognitive impairment for students with ADHD can result in emotional difficulties (e.g. feeling hostile, overwhelmed and depressed) (27). They tend to act impulsively, are introspective, repeatedly think about and regret past events, underestimate themselves, engage in a continuous cycle of worry and are anxious about the future (24; 43). Impairment leads to lower levels of intrapersonal skills, engagement and self-evaluations of academic and psychosocial functioning, which can influence their persistence in HE (27). Similarly, students with ASD (and their parents) experience feelings of ambivalence, stress and anxiety when they are confronted with challenges in the HE environment (31; 35). Students with ASD and ADHD have high levels of anxiety about their future personal and professional lives because of the anticipated difficulties they might face (25; 36). Common disorders for students with ASD and ADHD include generalized anxiety, social anxiety, depression, bipolar disorder,

obsessive-compulsive disorder, borderline personality disorder, dyslexia and dysgraphia (22; 25; 30). Sources of support consistent with a Universal Design (UD) approach, which caters for different preferences, leisure activities and a sufficient amount of rest and social learning, all have a part to play in helping these students to manage their stress and anxiety (12; 14; 36).

Personal and social life

Neurodiverse students feel anxious interacting with others and are inclined to isolate themselves from their peers (1; 36), despite a strong desire to make friends whilst at university (31; 36). Bullying, rejection and stonewalling from the peers are not uncommon (1; 13; 25).

Students with ASD have particular problems with verbal and non-verbal communication and are oversensitive to change (23). Their inability to read social cues and other people's expectations are barriers to initiating and sustaining social relationships (36). Social anxiety, fear of loneliness, nervousness and lack of spaces free from over-stimulation are the main barriers to socialization for students with ASD (31). Impairment associated with ADHD means that students have difficulties building and maintaining social relationships and with emotional outbursts (24; 25) that can be helped by parental involvement (28). While impairment means that poor motor skills isolate dyspraxic students (4), deficiency in executive functioning (e.g. cognitive processes, such as self-monitoring, prioritizing, understanding different points of view) is the main barrier resulting in students living at home with parents (5).

For autistic students, the transition to HE is characterized by apprehension (31), poor quality sleep, lack of structure, loneliness and sensitivity to noise, light or smells which affect their ability to cope or study (30). Unpredictability in HE programs impacts time management and the organization of daily activities (36), and students need assistance to foster daily living skills, such as cleaning, buying groceries and cooking (25). Students with ADHD experience similar challenges (24) but are less engaged in academic work, more inclined to health-risk behaviours, such as substances abuse (44), and spend more time playing video or computer games, partying and online social networking than their peers (27). Despite aiming to be independent (35), most students with AS and ASD require support to navigate university life (29).

Academic life

Although arguably integral to a university education, reading, writing, comprehension, decoding, word recognition, pronunciation, grammar and meaning-making (18; 12), or the technical aspects of writing, marginalize students with dyslexia (20). Academic achievement especially when higher-order skills, such as planning and organization, are needed (21) can also be compromised. Despite adopting a deeper approach to learning, compared to students without dyslexia (42), dyslexic students are easily distracted during lectures, note-taking is poor (10) and whilst face-to-face lectures with PowerPoint slides are helpful, they can be difficult to follow (9). UD initiatives, including clear instructions in multiple formats, optional group work, peer mentorship, digitally accessible materials and varied and flexible teaching approaches are helpful (2; 37; 39).

Students with ASD have problems in identifying critical points amongst detail, information processing, directing and shifting attention and cognitive flexibility (23). They procrastinate, lack concentration and focus, struggle to prioritize and complete tasks efficiently, resulting in poor academic performance and achievement (24; 25), which despite creating anxiety (30) does not lead to seeking help.

Identity and possible selves

Neurodiverse students entering HE have to assume adult roles and construct new social identities (35). Difference (otherness) is a prominent part of the self-concept of neurodiverse students (31) leading to different perceptions of ‘self’ and their learning difficulties. Whilst some students with ASD do not consider themselves to be disabled (40), positive acceptance of difference shifts focus to emphasize strengths to overcome difficulties (13; 14) and promotes positive action, such as disclosing difficulties to teaching staff (21). Students with ADHD exhibit low levels of self-efficacy (43), a quality that together with resilience is essential to success for dyslexic students (16) who associate strongly with a dyslexic identity (8). Despite making their lives more difficult, students perceive their dyslexia gives them strength to overcome difficulties (13) and draw on their social surroundings and familial support to help them achieve their aspirations (11).

HE’s response to neurodiversity

Disclosure and diagnosis

It is hard to support neurodiverse students in HE if they are unwilling to disclose their disabilities (30; 38). Staff are reliant on information provided by students and their parents (38). Some autistic students reject disclosure because they wish to develop independence and their new social identity (35), whilst others are concerned about the impact on their privacy and a lack of supportive policies (36). For dyslexic students, non-disclosure is fuelled by fear of being stigmatized, separated from the class and not being able to get good grades (25; 18; 38). Some students only disclose their disabilities when they can no longer cope, realize a specific support need or perceive that it is safe to disclose (36). Others do not want to be labelled, and as a consequence, have less support and a poorer university experience (30).

Encouragement to disclose and subsequent screening to confirm students’ learning disabilities (6; 27) leads to provision of assistive software tools and other assistance depending on identified need (19). However, a UD teaching framework emphasizing strengths could potentially decrease reliance on support and remove the necessity to disclose problems at all (30).

Reasonable adjustments

Although some students with ADHD do not use adjustments offered (48), the experience of neurodiverse students can be positive if, and when, reasonable adjustments are made (2). For instance, dyslexic students benefit from out-of-class support, in-class-support, examination adjustments, access to a resource centre, lecture capture and assistive technology (9; 10; 14). Advanced sight of lecture materials, extra time for coursework and permissions to tape lectures benefit learning (16). However, adjustments focusing on academic needs but ignoring sensory and social needs are inadequate for students with ASD (2) for whom sensory overload negates benefits of other adjustments on campus (36). In wider university life, self-catering halls of residence challenge students with weaknesses in executive functioning (5). These students might opt to attend an HEI closer to home where they can access support from parents and family (36).

Academic attitudes and expectations

Notwithstanding the importance of upholding academic standards, the literature suggests that the conditions imposed by academia can challenge neurodiverse students. Emphasis on written assessments and focus on grammar, spelling and punctuation can penalize dyslexic students (12; 20). Students with ASD struggle with traditional teaching and assessment methods (23). Students with ASD and ADHD find coping with academic demands, such as timed homework and quizzes, in-class notes and overall course load testing stressful (25; 30), despite being realistic in expecting to be challenged (27). In general, neurodiverse students report poor treatment, lack of support, inflexibility from lecturers (1; 13; 17; 25; 31) and perceptions of discrimination and judgmental attitudes when they disclose their learning difficulties (15; 25; 38). Such negative teacher attitudes are detrimental to the self-efficacy beliefs of these students (20) in need of institutional advocacy (15; 38).

Institutional support and pastoral care

Despite negative reports by neurodiverse students, support structures are in place in many HEIs. Support groups, counselling services (campus orientation, academic and psychological support and career advice), supervised social activities and summer transition programs are the most commonly provided support services in HE (29; 38). However, because support can come from several areas within an HEI, conflict and communication difficulties can lead to lack of consistency of support (1). Some areas fall beyond the scope of services, impacting on adjustments, and there can be barriers to providing discipline-specific support (17). Lack of funding and professionals specialized in neurodiversity (29; 38) can hamper program effectiveness resulting in students withdrawing from programs due to lack of follow-up, support and resources (30). Dobson (2018) identified variability in in-class adaptations/support, additional learning support (including mentoring and coaching), assistive technology and ICT, examination support and general disability support but found general screening of learning needs, dyslexia screening and full psychological assessment were available (7). These services were evaluated as helpful but difficult and time-consuming to organize (7; 9).

Emotional, instrumental, informational and appraisal support (from college staff, counsellors, friends and family) buffer students' college-related stress and facilitate academic success (12; 14; 15; 16; 21; 25). One study suggests that most students with ASD are satisfied with academic support services but are dissatisfied with non-academic support (30). Funding to access library helper assistance, mentorship, proof-reading assistance, examination support, note-taking support, help with essay and report writing and mathematics and statistics support can be fundamental to success (19).

Counselling services and guidance on educational progress are crucial to the success of students with ADHD (22), although they have been deemed less effective than services available in high school (21). Where parental involvement is high, these students have the lowest levels of impairment (28). However, peers, teachers, counsellors and other HEI staff all have roles to play in the academic and social life of students with ADHD and ASD (22; 25; 37). Strengths-based approaches and activities focusing on self-determination and regulation skills, particularly for autistic students, can empower (1; 34; 36; 37). Given the intensive time and emotional demands on staff, made by these students, recruiting passionate individuals is

crucial (29) if they are to respond to a demand-driven support approach that encourages participation (35). Overall, students need personalized coping strategies and customized support services to meet their unique needs (15; 18; 26; 27; 33; 34; 35; 36; 37).

Teaching, learning and assessment strategies

Teaching and learning approaches

In order to achieve deep learning in the light of cognitive impairment, students with learning disabilities require extra time to access specialized support and master technologies, alongside flexible learning opportunities (17; 39). An inclusive curriculum eradicates potential barriers to students' academic achievement (20). Students with ADHD perceive that they benefit most from interactive teaching approaches, group work activities (22) and coaching interventions (26; 46), whereas tutoring is best for addressing academic skills and knowledge deficits (26). Autistic students preferred to be monitored and supported by a personal coach, in educational, student and personal life (36) but peer mentoring was also beneficial (37). Participatory transition programming, utilizing mentorship, fosters self-efficacy and social skills for students with ASD (33; 34) and ASD and AS students' social and executive skills benefit from practical activities, such as giving a class seminar (29). Non-traditional educational approaches, such as tactile learning experiences, help dyslexic students learn more readily (14). For this reason, work-based learning experiences help to integrate theory and practice for these students (15).

Given that strategies to support neurodiverse students depends on their unique needs, the aim should be to mainstream initiatives consistent with a UD strategy, to meet individual needs that avoid segregation and isolation (14; 26; 27; 29; 30; 37; 47) and enable students to study to their strengths rather than emphasizing deficits (30).

Technological support

Consistent with UDL principles, lecture-capture (9; 10; 30), provision of learning materials in alternative or accessible formats (3; 19) and use of technology in the classroom (i.e. laptops, smart pens) (2) benefit many students. Ability to access relevant learning materials online at least a day before a teaching session is highly beneficial (19). Autistic students, in particular, gain from assistive technology that provides access to internet resources, reducing reliance on textbooks (10). Although varied teaching methods are welcome, students suggest an increase in the use of visual material, uploading videos to present content onto virtual learning platforms, hands-on activities and group work (12). Students with AS can successfully participate in teamwork with the use of online communication, which promotes inclusivity (32).

Despite students experiencing challenges associated with virtual learning environments (45), technology is hugely beneficial for the technical aspects of reading, writing and planning (20). Provision of free personal computers and/or additional assistive software, such as transcription software, text-to-speech systems, recording devices (audio and voice recorders), mind-mapping tools, interactive thesaurus/dictionary software and roaming user profiles, is also beneficial (7; 16; 19). A UD strategy might also include access to specialized programmes, apps, personal digital assistants and electronic organizers (39).

Assessment approaches

Although assessment can vary, traditional written forms, such as essays, continue to predominate (13). Neurodiverse students can benefit from alternative equivalent forms of assessment, such as multiple-choice and extended matching-question exams which are seen as dyslexia-friendly (13; 19), although most dyslexic students still need additional time for examinations (2; 16; 19). Sensitivity is needed in providing these adjustments as, although they support success, some students dislike being identified and labelled by these strategies (13).

Autistic students also benefit from examination assistance, such as extended test time, distraction-free test areas (i.e. in a quiet room, testing alone) and flexible or extended due dates for assignments (2). Spreading exams over time (to allow rest days between exams), doing alternative assignments instead of group work and taking exams in smaller than usual groups are also effective strategies which help students with ASD (23; 30; 36). Exam adjustments are perceived to be the most helpful type of support by the students with ASD (30) although adopting a UD approach to developing assignments which allow increased flexibility for all students might potentially be fairer (47).

Discussion

The reported experience of neurodiverse students in contemporary HE is sobering. A repeated theme is the *anxiety* that accompanies students through the personal, social and academic aspects of their studies, overlaying their learning difficulties with mental health and wellbeing concerns. The transition to HE is challenging for most students (Jackson 2010), but as Vincent et al. (2017) highlight, the perceived sense of *difference* which is a prominent part of the self-concept of neurodiverse students makes their transition overwhelmingly challenging. Many students feel out of place in what they perceive to be a highly competitive university environment (Shaw and Anderson 2018). However, aside from their engagement with academic expectations, their entire university experience, including management of change, negotiation of social interactions and striving to achieve a degree of independence, is clouded by past experiences and apprehensions (Kwon, Kim & Kwak, 2018). The fear is that without adequate support students turn to diversionary tactics, such as substance abuse (DuPaul et al. 2017b). Yet, fear of stigmatization and labelling (Wennås Brante 2013; Bolourian, Zeedyk and Blacher 2018), again probably as a result of earlier experiences, prevents or delays students disclosing their learning difficulties, resulting in an even poorer university experience (Anderson, Carter and Stephenson 2018).

As student perspectives confirm, it is crucial that HEIs find ways of encouraging students to disclose their disabilities, assess learning needs and put in place relevant support mechanisms (DuPaul et al. 2017B; Taylor et al. 2016). A wide range of support systems and assistive technology is available, but the onus is on students to trigger this by disclosing their difficulties. However, these processes can be time-consuming and frustrating to navigate (MacCullagh, Bosanquet and Badcock 2017), suggesting room for improvement. Van Hees, Moyson and Roeyers (2015) point out that students will only disclose when they can no longer cope or when they perceive that it is safe to do so. Reaching a crisis should be avoided, therefore creating a trusting and inclusive environment tolerant of difference is essential (Glazzard and Dale 2015).

Here lies the primary challenge: the response to neurodiversity amongst staff appears, at best, mixed. Lecturers can be inflexible, unsupportive and judgmental (Bolourian, Zeedyk and Blacher 2018; Shaw and Anderson 2018; Vincent et al. 2017; Couzens et al. 2015; Child and Langford 2011; Griffin and Pollak 2009). These people are not bad people; their attitudes are likely fuelled by low levels of knowledge and awareness that militate against difference and willingness to think inclusively. This is reflected in reliance on traditional teaching and assessment methods, which penalize neurodiverse students (Jansen et al. 2017; Smith 2017) and create academic demands and workload that is unbending, and risks attrition and failure (Bolourian, Zeedyk and Blacher 2018; Anderson, Carter and Stephenson 2018).

A distinct finding highlighted across the neurodiversity spectrum is the need to see each individual as having unique needs (Barnhill 2016) that challenges a one-size-fits-all ethos that can prevail in HE. Educational practices adapted for varied learning preferences or UDL (Sarrett, 2018) are evident in many of the articles in the synthesis. However, explicit reference to universal design for learning principles (UDL) and its adoption as a consistent strategy appears less common. Sarrett (2018) suggests that UDL implementation is inconsistent, and students have difficulty in obtaining adjustments, whilst others argue that it is poorly understood by academic staff highlighting the need for training (Couzens et al., 2015). Perhaps not surprisingly, student attitudes to UD initiatives appear to be mixed but increased flexibility and breadth of awareness are identified as important in addressing different needs. Many of the ideas are simple to implement and could be mainstreamed to potentially benefit all students thus avoiding labelling and segregation of differently abled neurodiverse students (Anderson, Carter and Stephenson 2018; Berry 2018; Shattuck et al. 2014).

Limitations

We acknowledge that by adopting a social model of disability, we give prominence to the influences of the environment alone on how disability is experienced. Our choice to diminish the impact of cognitive impairment associated with neurodiversity is based on the rationale that as a socially constructed environment, academia has a major role in minimizing disability caused by the impact of impairment. While an alternative social cognitive lens might provide a more nuanced view of disability for future researchers, it brings impairment back into view, and as such, provides sufficient scope for ambiguity to obfuscate the need for change.

Despite aiming to offer an international perspective, the majority of research accessed as part of this review comes from a limited number of mainly English-speaking countries in the northern hemisphere. Insight into practices in countries in Oceania, South America, a large part of Africa and some parts of Asia are excluded, at least partially because non-English language publications were excluded. We are also conscious that like general disability research (Thompson 2016), the analysis focuses on neurodiversity to the exclusion of other characteristics such as ethnicity; we, therefore, assume that we portray a largely white perspective. Interestingly, only a small number of studies include academic and/or technical support staff perspectives creating the risk of an account biased by emotive experiences, disenfranchisement and marginalization. Furthermore, the predominant research approach was qualitative in nature, with fewer studies using mixed and quantitative designs. As highlighted previously (DuPaul et al. 2017A; DuPaul et al. 2017B), there is a need to design more interventional and longitudinal studies using methodological triangulation to improve our understanding of neurodiversity in HE.

Conclusions

The increasing number of neurodiverse students entering HE poses a shared and growing challenge internationally for teachers and institutional leaders. This narrative review of studies highlighting neurodiverse students' experience HE, and the ways in which HEIs respond, integrates a wide range of literature to provide new and significant insight into unexpected commonalities in student experience, some good practices in place in HEIs, and yet considerable room for improvement. Many HEIs appear to be neurodiversity 'cold spots' despite the existence of support services; the dislocation maintained by low levels of staff awareness, ambivalence and inflexible teaching and assessment approaches. Reflecting the generic disability picture in HE, and potentially of greater impact, disclosure of learning difficulties is a major issue from which all academic and pastoral support and adjustments flow. Intransigence persists, despite the number of neurodiverse students entering HE rising. Universal design strategies that offer customized support services, flexibility and neurodiverse-friendly environments can help to meet students' unique needs, but their use appears piecemeal. A major catalyst appears to be the creation of a trusting and inclusive environment tolerant of difference that does not need labels, adjustments or special measures that will allow *all students* to flourish.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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