# Neurodiversity in Education

Diversity in the classroom includes differences in the way students' brains learn, or neurodiversity. Neurodevelopmental disorders such as autism spectrum disorder (ASD) and attention deficit hyperactive disorder (ADHD) affect increasingly large numbers of students. Education systems must work to meet the needs of these students and ensure that all types of learners thrive at school and beyond.

Neurodevelopmental diversity: the cases of Autism and ADHD

Neurodevelopmental disorders (NDD) can affect emotions, learning ability and memory. Diagnoses of NDD have been on the rise, although there are questions about how much of the growth is due to greater awareness and better diagnoses rather than a real increase in prevalence. The consumption of medications for a particular disorder is one way to track the trends. For example, the use of the ADHD medication methylphenidate has increased dramatically in some countries in the last two decades (Figure 1). Canada, Iceland, and the US are some of the countries with the largest reported consumption rates in recent years, followed by Denmark, the Netherlands and Sweden (INCB, 2017).

Figure 1: Global consumption of ADHD medication (Methylphenidate), 1990-2013
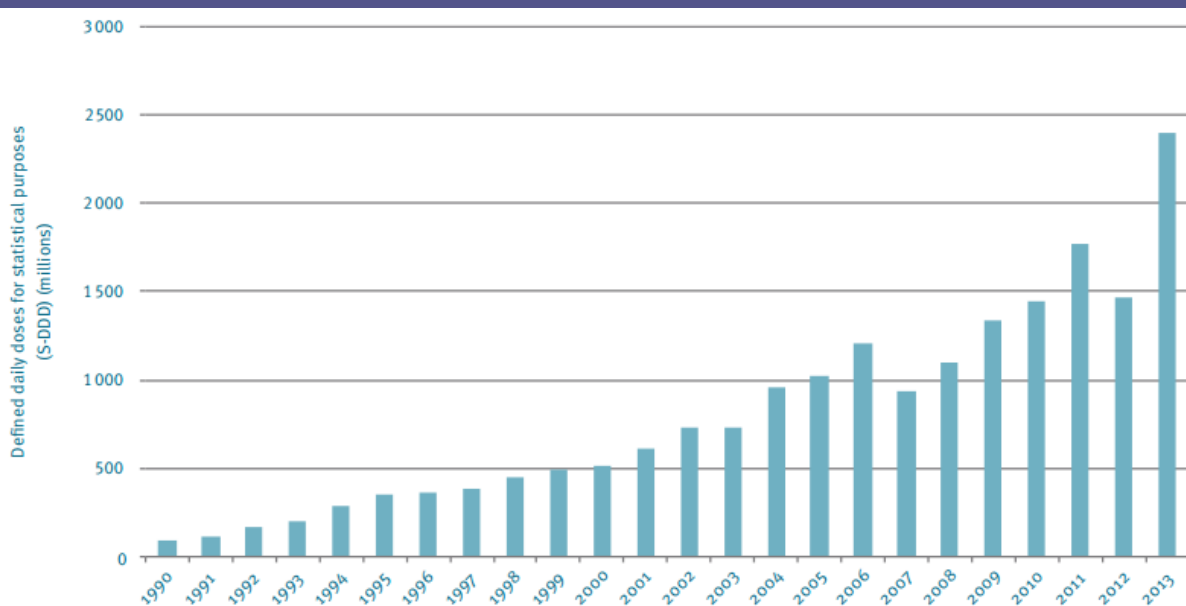
Note: consumption rates are calculated in millions of S-DDD (defined daily doses for statistical purposes).
Source: INCB (2014), *Annual Report 2014*, United Nations, New York,
https://www.incb.org/documents/Publications/AnnualReports/AR2014/English/AR_2014.pdf.

ASD, which occurs along a spectrum of severity and includes Asperger syndrome, is characterised by difficulty with social interaction, dealing with change, and flexible thinking. Cognitive abilities of children with ASD can range from gifted to severely-challenged. Explanations for the growth in diagnoses of ASD include increased awareness, improved medical training and detection, gene expression and heredity, and may also be linked to other factors during pregnancy and childhood, such as environmental pollutants (Landrigan, 2010).

Environmental pollutants present in cosmetics, toys, food or pesticides are increasingly linked to the rise in neurodevelopmental conditions (Demeneix, 2014).

Stigmas attached to the diagnosis in some countries can result in under-identification: for example, two-thirds of ASD cases identified in a Korean sample when diagnostic assessments were administered were otherwise undiagnosed and untreated (Kim et al., 2011).

Language barriers and lack of parental awareness of neurodiverse conditions can also result in under-identification. This is the case of Latino children with ASD in the US, who are diagnosed less often and later than are white children on average (Zuckerman et al., 2013). In fact, ASD identification and parental level of education and income are strongly and positively related in the USA, as highly-educated, wealthier parents more successfully seek access to medical services (Van Meter et al., 2010).

Another example of neurodiversity is ADHD, which is characterised by impaired or diminished attention, impulsivity, and hyperactivity, and can impact students' learning abilities. ADHD diagnoses have been rising in a number of countries, including Brazil, France, Germany, Italy, the UK and the USA (Conrad & Bergey, 2014). In a number of other countries, systematic reviews are now underway to collect comparable data.

Multiple neurodiverse conditions can occur simultaneously. For example, some children can have symptoms of both ASD and ADHD (Carrascosa-Romero & Vega, 2015). Given the growing population of students who identify as neurodiverse, education systems need to be able to meet these students' social and learning needs in ways that accommodate the most and least severe, as well as borderline, cases.

Teaching neurodiverse classrooms

It is no longer uncommon for teachers to have a class with a diverse range of learning preferences and abilities, including children with different cognitive abilities, hyperactivity, and emotional difficulties. With such a complex combination, maintaining a balance between equity, delivering a fair and excellent education to all, and catering to individual learning needs has made a teacher's job extremely challenging (Lamport, Graves & Ward, 2012). Teachers need supportive policies and frameworks to provide quality learning experiences to all students and build on their diverse strengths.

Inclusive classrooms

The discussion of how to meet the needs of students with learning differences often begins with whether students with neurodevelopmental disorders should be included in typical classrooms or be given separate learning environments. There is a growing trend towards all children having the right to mainstream settings if the families so choose (i.e. inclusive education). Families can also consider whether a specialised education setting might suit their child's needs better. For example, some children with severe impairments and unique needs might benefit from catered educational settings.

In the United States all children and youth (ages 3-21) who are diagnosed with one of thirteen recognised learning disabilities are entitled to free public education through the Individuals with Disabilities Education Act (IDEA). The legislation also requires schools to provide learning environments, activities and assessments personalised to the specific student's needs, including whether mainstream inclusion is the best option. Individualised Education Programs (IEP) additionally require all students to have a transition plan in place for their future workforce involvement (Roux et al., 2015).

iTaalk Autism Foundation

The iTaalk foundation in the United States specialises in helping educators, service providers and families with how to use technology for students with autism. Audio-visual aides such as graphs, pictures and voice instructions can help some neurodiverse students learn.

The foundation additionally provides a network to support and advance research and practice in technology for neurodiverse students. Initiatives such as iTaalk can create a culture of professional development for progressing pedagogy catered for neurodiverse students.

More information: https://www.itaalk.org/

Inclusive education may help neurodiverse students develop social skills that can encourage social integration and friendships with their peers. It can also have unexpected benefits: research has found that intellectual disabilities commonly believed to be unrelated to ASD may actually be a consequence of ASD-related social-communication deficits that affect neurocognitive development (Vivanti et al., 2013). Thus, mainstreaming students with social-communication deficits can have further positive effects, such as mitigating intellectual disabilities.

Inclusive education can further serve as a catalyst to improve positive perceptions of neurodiverse peers, as well as dispel myths. For example, in a survey conducted in the United States, 43% of participants believed wrongly that learning disabilities are correlated with IQ (Cortiella and Horowitz, 2014). Inclusive education can also decrease costs for schools, as specialised classrooms are not needed, and help to build tolerance for diversity among students.

> Co-teaching is a partnership between a general education teacher and a teacher who is experienced in teaching students with learning differences (Rytivaara, 2012).

For inclusive education or specialised education to be successful, teacher professional development and support are critical. Currently, teacher training for neurodiverse students has a wide range of techniques and models, with little academic consensus to guide teachers (Oliver & Reschly, 2010).

Many teachers feel inadequately prepared for meeting the needs of neurodiverse students. In the last two versions of the TALIS survey, teachers consistently identified teaching students with special needs as their first need for professional development (see Figure 2; teachers were not asked specifically about neurodiverse students). Student behaviour and classroom management were identified as their third professional need. The quality of the training is key: although 32% of teachers report having taken part in professional development that focused on teaching students with special needs, 7% reported that it had small or no impact on their teaching and 25% reporting large or moderate impact (OECD, 2014). Upskilling teachers in this area is a key issue that concerns both pre- and in-service teacher education.

Figure 2: Percent of teachers who report a "high" level of need for professional development
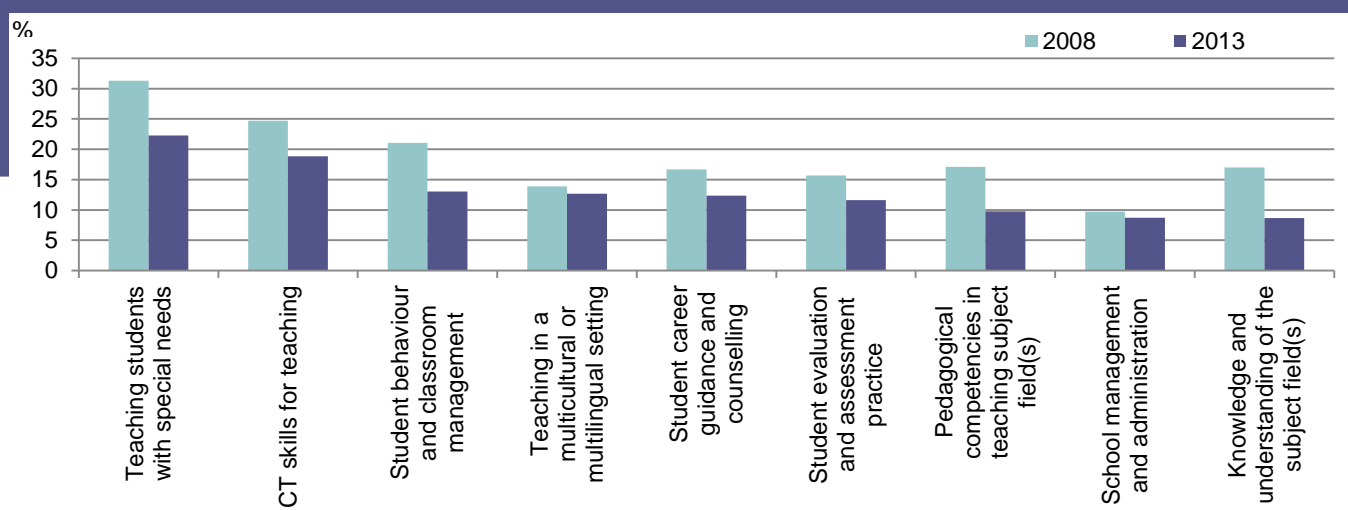
Source: OECD (2014), Table 4.12.c. Teachers' needs for professional development, 2008 and 2013, *in TALIS 2013 Results*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264196261-table178-en.

Adapting teaching practices: personalised education

"Personalised education" is the idea that individual adaptations can be made within the classroom to cater to each learner and their different needs and abilities (OECD, 2006). Individualised education plans may be an especially

> Personalised education training for teachers blends learning sciences, neuroscience and evidence based practices (OECD, 2006).

helpful tool for educators with ADHD or ASD students. They include an assessment of the child's specific learning needs, the services that the school can provide, and how progress will be measured.

Teacher education for personalised education and other methods that address diversity in the classroom need to be supported on a system level. This requires policies that embrace neurodiversity, as well as legislations and funding schemes such as reform in assessment arrangements, school structure, class size, training and professional development, with a strong focus on rigorous evidence. Teachers can also be supported by professional learning networks, their community, parents and other experienced stakeholders such as foundations or NGOS. Such a whole-of-society effort can help teachers feel more prepared when working in neurodiverse classrooms.

Assessing neurodiverse students

Consistent with the inclusion model, many OECD countries require that young people with special learning needs participate in similar academic assessments to their peers (OECD, 2016), with perhaps some modification depending on the severity of their disorder. An ongoing issue in neurodiversity research and practice is how to assess students without subjecting them to uncomfortable environments or activities that may not accommodate their needs and skills.

This is a real challenge. Inclusive education and inclusive assessment do not inherently complement each other. Standardised tests are not designed for neurodiverse students, and comparing scores - even with modified questions – may not be appropriate.

On the other hand, assessments reinforce the fact that: 1) academic learning is not secondary for neurodiverse students; 2) it is appropriate to have academic goals for these children, as for all children; and 3) monitoring outcomes for neurodiverse students can help keep systems accountable for achieving learning gains for all.

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Small changes to the assessment process may be needed. For example, to accommodate ADHD students, tests could alter their structure and time, as ADHD students may find it difficult to sit for long periods of examination. For students with ASD, nonverbal intelligence assessment could be considered, along with other adaptive measures such as taking the test in a quiet room alone. Some of the modification options available for teachers and school administrators for accommodating students with ASD are presented in Table 1. Many of these strategies are also helpful for neurotypical children.

Table 1. Types of modifications for standardised tests for students with ASD

Type of Modification	Description/Examples
Examiner	Introduce the examiner to student beforehand may lower anxiety and better assess where modifications are needed
Sensory	Depending on student ability, find suitable visual and/or audio aids
Routine	Be mindful of disruptions to normal schedules that may affect the student; give prior warning and be least disruptive as possible
Environment	Administer test in friendly environment, minimise distractions
Time	Allow for extra time
Directions	Give clear and concise directions, and depending on the student, also incorporate visual directions and communication
Motivation	Interject simple tasks into the testing process or use positive reinforcing statements to keep students motivated
Behaviour	Assess student behaviour throughout the process, and use positive reinforcing statements to reduce the rate of interfering behaviour

Source: Adapted from Loftin, R. (n.d.).

In addition to making assessment work for individual neurodiverse students, there are also systemic issues to consider. One important concern is the impact of a competitive test culture on who is considered neurodiverse. When stakes are high in school assessment, teachers and schools may try to intentionally leave low-performing "neurotypical" students out of the test population by classifying them as "special needs". High external pressure on schools might be a cause for the growth in the proportion of students classified as special needs (Mjaavatn, Frostad, and Pijl, 2015). This is the case, for example, in the US: in states that have passed laws that tie funding to results on standardised testing, the rates of ADHD diagnosis have also been rapidly increasing (Hinshaw & Scheffler, 2014).

Assessment and evaluation for neurodiversity is a complex issue and new assessment methods that are suitable for a range of students and learning skills need to be explored. Despite the challenges, avoiding assessment is not a solution: if educational methods are to improve, there first needs to be more evaluation of programmes and evidence-informed practices to support neurodiverse students.

Risks for neurodiverse students

Neurodiverse students may struggle in traditional school environments, especially if teachers and peers poorly understand their differences. For example, ASD is correlated with anxiety and aggression, and as many schools are advised to suspend students at the first sign of aggression,

> Students with ADHD may experience difficulties in navigating school social environments (Sibley, Evans, & Serpell, 2010).

students with ASD are more likely to be suspended from school than are their peers (Ambler, Eidels, & Gregory, 2015). ADHD students are also at greater risk of dropout and expulsion than their peers (Loe & Feldman, 2007).

In addition, neurodiverse students are more likely to either find themselves the victims of bullying or bully other children (Mayes et al., 2015). Other studies also highlight cyberbullying as a risk factor to those with ADHD and ASD, as many of them spend an increasing amount of their leisure time online (Kowalski & Fedina, 2011).

To protect all students, schools need to screen more frequently for bullying and victimisation behaviours and tendencies, and also need to explore preventative schoolwide interventions that inform and teach all members of the school community about behavioural expectations (OSEP, n.d.). When a safe and supportive school culture exists, teachers are more likely to change their attitudes and support greater acceptance and accommodation of children with special needs (Dupoux et al., 2006).

Medicalisation of neurodiversity

Many neurodiverse disorders can be treated with medication. As ADHD diagnoses have grown more prevalent, so too has the number of prescriptions for medication to treat the condition, particularly stimulants such as Adderall or Ritalin.

However, as rates of ADHD diagnoses rise, there are fears that it is becoming medicalised and drug treatments are too widely relied upon, even though their long term effects are unknown – especially when children take a combination of drugs. A pill as an "easy solution" might mean that behavioural strategies might not be tried. Possibly as a reaction to this, alternative treatments such as homeopathy (e.g. Frei et al., 2005) and Omega-3 supplements (e.g. Bloch and Qaqasmi, 2011) are emerging for ADHD, despite a lack of strong evidence of their effectiveness.

Another concern is that increasing the availability of these drugs may contribute to some students without ADHD experimenting with ADHD medication (Lakham and Kirchgessner, 2012). These concerns are heightened by the belief that these medications can be used to improve cognitive abilities (the so-called "smart drugs"), although the evidence of whether they boost academic performance is slim (Ragan, Bard, & Singh, 2013). This is a serious concern, particularly given evidence demonstrating that short-term gains in memory or concentration are later paid for by a long-term decrease in brain plasticity necessary for mental flexibility (Urban and Gao, 2014).

From school to work

Accessing, adapting to and remaining in the labour market is not easy in the context of neurodiversity. Individuals with an ASD are more likely to be unemployed and underemployed. They are also more likely to experience high job discontinuity and make less money than their co-workers (Hendricks and Wehman, 2009; Hurlbutt and Chalmers, 2004; Marwaha and Johnson, 2004).

Although there is little work specifically on neurodiverse populations, young adults with disabilities often report that they struggle to find work after secondary or tertiary education (Ebersold, 2012). Employment levels vary, but a survey of 51 countries found that on average, 52.8% of men with a disability were employed compared with 19.6% of women (WHO, 2011). Employment rate is heavily dependent on the type of disability and severity. For example, for those suffering from mental health conditions, moderate to severe diagnoses often have a large impact on their likelihood of working (Figure 3).

Figure 3: Unemployment rate (as a proportion of labour force) by severity of mental ill-health
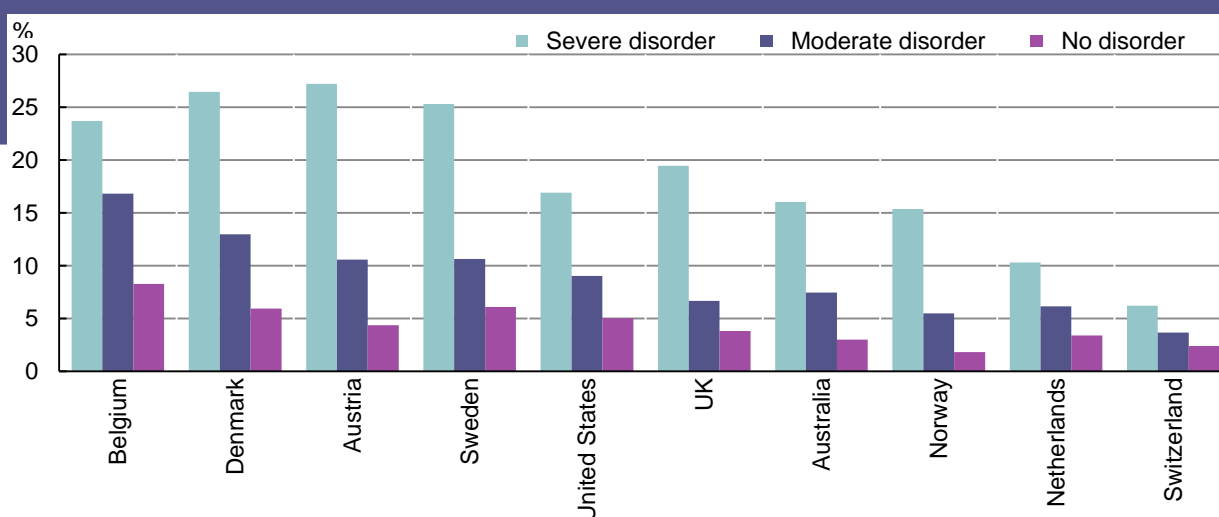
Note: Latest available year; countries arranged in order of average unemployment rate.

Source: OECD (2015) Fit Mind, Fit Job: From Evidence to Practice in Mental Health and Work, Mental Health and Work, OECD publishing Paris, http://dx.doi.org/10.1787/9789264228283-en.

In the United States, individuals with ADHD are less likely to work by 10-14 percentage points and are estimated to have reduced earnings of around 33% (Fletcher, 2013). While some of these differences may be attributed to unequal educational attainment outcomes and/or social-communication abilities, this does not explain the difference in employment fully (Fletcher, 2013).

Some employers are reluctant to employ people with ASD or ADHD, fearing that they are less productive. However, in many cases, neurodiverse young adults do not lack the intelligence or capacity to develop knowledge and talent based professional careers, but have challenges in meeting the social and communication expectations of recruitment processes and integrating into the workplace. Factors such as stigma, discrimination, inflexible working environments, low expectations among families and employers, and a lack of appropriate professional help may also act as powerful barriers to sustained and successful working experiences.

Our conceptions of the workplace are undergoing a drastic transformation. More dynamic and social workplaces are increasingly becoming the rule as many employers are realising that a happier employee is also more engaged, productive and creative. Adults with ADHD can be as productive as their peers if appropriate accommodations and treatment are provided. Similarly, many people with ASD can thrive in a structured and well-organised environment (WHO, 2011).

Autism at Work with SAP

SAP, an international software company, has partnered with Specialisterne, a Danish non-profit talent and career organisation to create the 'Autism at Work' programme. This initiative aims to ensure that 1% of all SAP employees will be represented by people on the autism spectrum by 2020. This equates to about 650 people across Australia, Brazil, Canada, the Czech Republic, Germany, India, Ireland, South Korea, and the United States.

The programme provides workplace and personal-life support to its participants, involving corporate staff from the project management level to colleagues and specialised personnel.
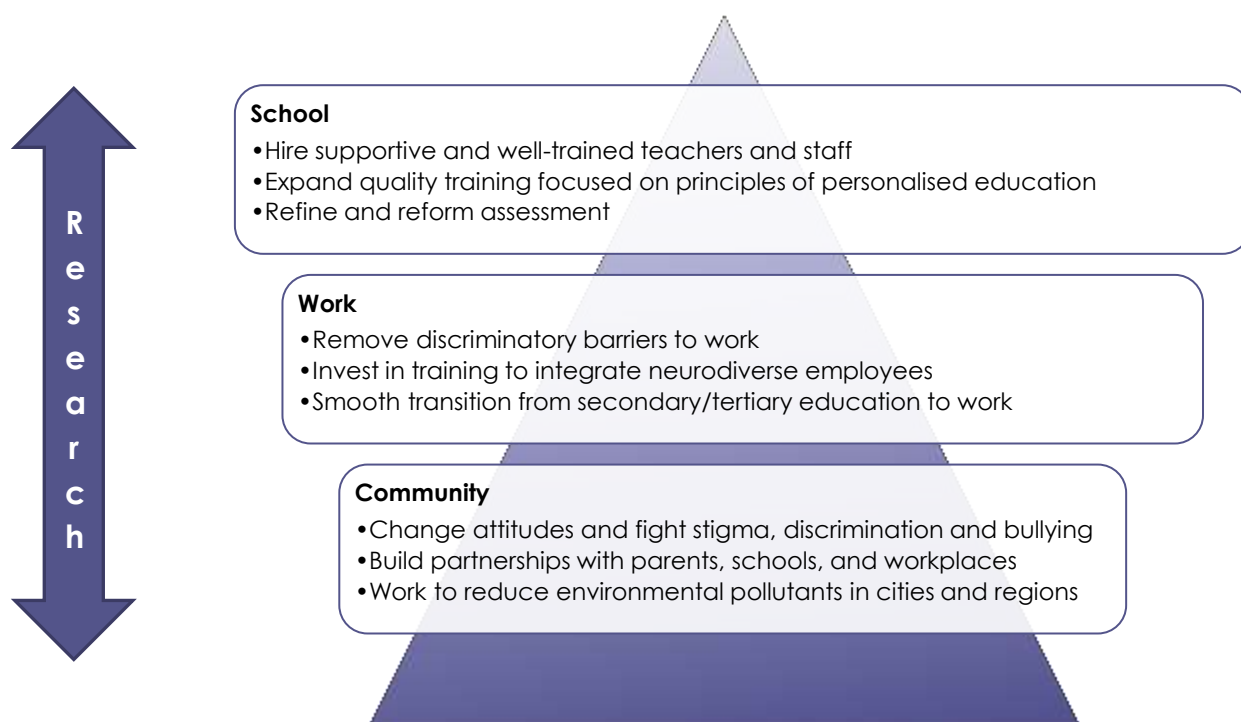
More information: http://go.sap.com/corp orate/en/company/diversity/differently-abled

Neurodiverse adults might have difficulties performing certain kinds of jobs, but can excel in others. Solutions to improving employment rates for neurodiverse individuals include expanding education and vocational rehabilitation and training, strengthening transition strategies to secondary and tertiary education, improving workplace culture and environment to be adaptable to neurodiverse workers, and improving perceptions of neurodiverse individuals (WHO, 2011).

Education programmes covering the main aspects and practical consequences of these kinds of disorders can be directed to employers and co-workers, as well as included in HR training to improve neurodiversity awareness and perceptions in the workplace.

Towards the Future

All students' brains learn differently. Neurodevelopmental disorders such as autism spectrum disorder (ASD) and attention deficit hyperactive disorder (ADHD) affect increasingly large numbers of students across the world. There are a number of different ways in which our education systems, workplaces and communities can help all individuals thrive at school and beyond.

Research

School
- Hire supportive and well-trained teachers and staff
- Expand quality training focused on principles of personalised education
- Refine and reform assessment

Work
- Remove discriminatory barriers to work
- Invest in training to integrate neurodiverse employees
- Smooth transition from secondary/tertiary education to work

Community
- Change attitudes and fight stigma, discrimination and bullying
- Build partnerships with parents, schools, and workplaces
- Work to reduce environmental pollutants in cities and regions

Questions for future thinking:

1. Greater awareness will likely result in a continuing increase in diagnosed individuals. What strategies will allow us to better prepare schools and teachers to meet their needs? What are, for example, the implications for pre- and in-service teacher education?

2. How can assessment methods at school better reflect the strengths of neurodiverse students? What would more personalised academic assessments that account for neurodiversity look like?

3. In the coming decades, increased digitalisation and automation will reshape the demand for skills in the labour market. How can we make sure that the education of neurodiverse students will meet both their individual needs and the future needs of the workplace?

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