

# The Journal of Inclusive Practice in further and higher education

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NATIONAL ASSOCIATION OF DISABILITY PRACTITIONERS

## Editorial

Sincere thanks to Dr John Conway for guest editing issue 4.1 of The Journal of Inclusive Practice in Further and Higher Education. I am delighted that the journal is continuing to develop while remaining true to its principles (which are reflected in the Editorial Guidelines which appear at the end of every edition). Feedback is always welcome and The Editorial Board is particularly keen to know how the new electronic presentation is received by the readership. As NADP members are increasingly taking up the opportunity to work towards Accredited Member status, the Editorial Board anticipate a renewed enthusiasm for writing for the journal. Splitting contributions into refereed and non referred categories may make potential contributors feel more confident about submitting and it would be interesting to receive views on this innovation. Thanks of course also go to reviewers and authors. Happy reading.

### **Dr Nicola Martin. Editor.**

This latest edition of JIPFHE was intended to focus on disabled students' experience of STEM subjects and includes two papers on maths. Several other papers were offered around dyslexia and related SpLDs and it's interesting to consider Pat Mulcahy's propositions around integrating AT and dyslexia study skills.

NADP has decided to move toward electronic publishing both to improve accessibility and to reduce our environmental footprint. This edition is the first to be available only electronically. Members will be able to access it from the members' area of the website in advance of it going on general release.

As we go to publication, news has broken of the Disability Standard awards managed by the Employers' Forum on Disability where two key supporters of disabled students figure in the top 10; Microlink at number 1, lansyst at number 4. Microlink is also named the best SME and its CEO and co-founder, Dr Nasser Siabi is named as a Disability Champion. NADP would like to extend its congratulations to both companies, and to Nasser who commented:

“ I am very proud that our industry is playing on the bigger stage to drive forward the disability inclusion agenda. There is tremendous potential for those involved in the DSA market to lead on innovations and export their expertise to the rest of the world.

All the good work we have been doing for the employment sector is built on our experience gained from many years of working in the DSA market. We

must preserve this great scheme and have promote it to other countries as a great beacon of success.

It is vital to have a joined up service for people with disabilities to live and work in the society. Therefore it is important that students with disabilities leaving education receive the same level of support in work place as they did during their studies, hence we are working with SLC and DWP to make this becomes a reality soon”.

Ian Litterick, iansyst Executive Chairman, said

“We are very pleased that two comparatively small DSA assistive technology providers were able to rate at the top with many of the country’s biggest and best resourced organisations. Being involved with the DSA and all its stakeholders helps to ingrain disability consciousness, keeps us learning and helped us to reach no 4 at our first attempt at the Disability Standard. It’s great to have recognition where we try to achieve excellence.”

Full details of the criteria and the awards can be found on the website...

<https://www.disabilitystandard.com/awards/2012-awards/>

**Dr John Conway,**

**Guest Editor.**

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# Promoting Inclusive practice in mathematics and statistics

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## **Abstract**

This article describes a teaching approach designed by the author to maximise student participation and enhance students' learning experience in undergraduate mathematics and statistics service courses.

The author's aim is to effectively address issues arising from neurodiversity identified with students' specific learning differences that are possibly manifestations of their negative attitudes towards mathematics and statistics. These differences influence the student's abilities to learn in normal learning environments by conventional methods and may be either because of previous unpleasant experiences of engaging with the subjects or other contributory factors such as specific learning differences. Further, based upon the author's experience described in the article, it is proposed that students who identify with Asperger Syndrome may benefit from her approach.

This article reports on the author's approach that positively contributed towards improving students' perceptions of mathematics and statistics. Further, it enhanced student engagement, their academic self-efficacy, promoted student participation and created interest in the subjects.

## **Background and issues**

The author is involved with teaching mathematics and statistics courses to undergraduates on a variety of degree programs such as Actuarial Science, Econometrics & Mathematical Economics, Accounting & Finance and Management Sciences.

As a result of this variety, students have different expectations of these courses. Students are from a variety of cultural backgrounds which influence their preferences for teaching approaches and learning styles they feel comfortable with. Students'

individual learning requirements, as a result of their wide ranging academic backgrounds, must be appropriately addressed. Further, students' poor perceptions and negative preconceived notions of the subjects need to be carefully addressed as these two factors obstruct the engagement and learning process of students as observed by the author.

Finally, students with learning difficulties may experience discrimination due to attitudinal barriers in education which can be removed by changing the teaching approach and designing class activities to promote participation. The author's teaching approach aims to remove such barriers so that disabled students are not at any disadvantage in the learning environment (Hornstra, Denessen, Voeten, van den Bergh, & Bakker, 2010)

### **The main hypothesis**

A student centred teaching approach (SCTA) will enhance student engagement and participation taking in to account students' diverse academic and cultural backgrounds and/or learning differences.

The two related research questions about such an approach are:

1. Would a SCTA promote inclusive teaching practice in mathematics and statistics?
2. Would a SCTA enhance students' confidence and positively contribute to their academic self-efficacy?

### **Methodology**

The author's teaching approach is developed, reviewed, revised and modified based upon the outcome of an open ended informal questionnaire e-mailed to all (175-200) students two weeks after teaching commences as below:

1. What aspects of my teaching help you engage and learn in my classes?
2. What prevents you from learning?
3. What would you change or modify about my teaching?

Further, the author is perceptive to students' spontaneous feedback which is highly valued because it is unprompted and often provides relevant information. This is compiled by storing data of students' comments during office hours and students' unprompted emails reflecting useful feedback.

## **Key points**

A variety of learning and teaching activities in this approach are used to

1. Kindle students' interest in mathematics and statistics
2. Enhance students' learning experience in lectures and classes
3. Widen student participation and promote interaction
4. Improve students' perceptions of the subjects
5. Act as a facilitator and a guide to students

## **The approach**

The approach discussed below is developed with the aim of effectively addressing the variety of learning requirements of students and improving their perceptions of the subjects. This is done by using carefully designed formative assessments, providing constructive feedback, and promoting interaction in lectures and classes. Further, the author designs lectures and classes to help students overcome their anxiety as a result of negative pre-conceived notions about the subjects.

A short formative assessment question or a multiple choice question (MCQ) based on key ideas in previously covered material is used to begin classes. It is important to diminish test anxiety (Benson 1989) which is done by assuring students that the purpose of the question is to facilitate learning and not to test them. The answer is displayed with a brief explanation after two to three minutes. Students' comments show that this helps students to link new concepts with their existing knowledge. "The richer the links between new and existing information, the deeper the knowledge and the more readily it can be retrieved and applied in new situations" (Zull 2002). Students' confidence is enhanced either because they arrive at the correct answer or because they learn something from the displayed solution. This facilitates interaction, creates interest, makes students receptive to the rest of the class content and positively contributes to the learning climate. The author ensures that students' participation is acknowledged by encouraging comments and positive statements on students' contributions in general without referring to those who get the correct answer. This can make a difference to their participation with future class activities and also ensures that they view it positively. Constructive comments on students' performance continue to enhance their interaction and perceptions of mathematics and statistics. A similar approach is successfully used by the author in

lectures to large groups of 300 or more students repeating the process at least twice. This enhanced interaction in lectures as observed by the author and improved students' attendance as shown by attendance records. It can make lectures more interesting, lively, engaging and interactive.

“A well planned thoroughly prepared lecture could be forgotten once the lecture is finished. It is important for lecturers to create an atmosphere that is conducive not only to the free exchange and expression of ideas but also to promote further curiosity in the subject. It is equally important to be empathetic to those that believe they lack the aptitude for Mathematics. It is crucial for the lecturer to make a conscious effort not to allow the complexity of the subject to overwhelm the audience” (Kotecha, M. 2010a).

Students who have low confidence due to any reason find this experience extremely exciting and begin to feel confident to engage with the subjects as demonstrated by the students' increased interaction with the author as well as their peers. Their comments reflect how their confidence grows as they continue to participate and get correct answers, which gives them the sense of achieving something they previously viewed as inaccessible.

Short questions and MCQs are also useful for diagnostic purposes to gauge their knowledge and grasp of concepts covered. This process helps assess a variety of learning outcomes and identifies problem areas and individual learning requirements that need to be addressed, enabling teaching to be suited to their requirements. Application questions are used in classes and students are advised to work in groups under the author's guidance in a workshop setting. The author circulates playing the role of a facilitator guiding students as they engage with group work and seeing students individually if they are working on their own. These questions are carefully designed and set on themes students can relate to and view as “fun” questions (Kotecha, M. 2011b) which positively contribute to their engagement. “Our students need practice with manipulating information to solve problems...we require creative thinking in order to solve new and unusual problems that demand new and unusual solutions” (Ebert and Ebert, 1998).

Students from certain Asian countries usually show a strong preference for teacher centred styles of learning probably because they are used to a system that lack student-centred learning activities (Chan, 1999 and ICME 2012). Such students initially show a preference to work on their own, which may be due to their cultural

background influencing their views on the teacher's role. There are several other reasons such as diversity in learning style preferences and past learning experiences that could prevent students from participating in group work. Students usually, after about two to three classes, learn to be active participants, make meaningful contributions and are not only happy with the teacher acting as a facilitator but also benefit from it. This is demonstrated by their improved engagement in classes. This enhances student participation, promotes discussions and facilitates deep learning as they engage with discussions about their approach to these questions. Further, group work helps them develop interpersonal skills, effective communication, team working, and the ability to effectively contribute to discussions. It promotes creative/reflective approaches to problem solving and contributes to active learning. Students who may identify with Asperger Syndrome (AS) are unlikely to get used to group work and require teacher's assistance with such activities. Students with AS often find it difficult to follow instructions such as "Work with the student seating next to you" or "Get in to groups". They need to be assigned specific tasks and prefer structured learning activities, which applies even to a brain storming session (Young, R. 2008).

The workshop setting makes it possible for the author to circulate and see students individually to identify their strengths, specific learning requirements, concerns and anxieties. This is because it enables the author to talk to students in an informal setting which puts students at ease creating opportunities to share their concerns with the author. A minority of students may take a bit longer to relax, but they soon get involved and contribute to group work and make excellent use of this opportunity. They find it easier to share their course related queries and anxieties with the author without becoming self-conscious in the presence of their peers. It helps the author to effectively address individual requirements of these students and provide them with appropriate support and guidance by advising them to use her office hours.

The author argues that students who identify with AS may benefit from the opportunity to receive help and attention on a one to one basis in a class setting. The author is able to provide students with constructive feedback, step by step instructions, guidance and support as required. The author is able to give students individual attention during the workshop session and remind students of their strengths which positively contributes to boosting their confidence. Danny's case included in this article briefly describes how he/she benefited from the author's

approach. Danny signed a disability disclosure agreement and his/her real name is not used in order to preserve his/her confidentiality. Further, all students whose comments are included in this article are informed at the outset that their feedback/comments may be used for academic related purposes.

Students enjoy working on the author's application questions and begin to view mathematics and statistics as enjoyable subjects rather than abstract subjects that involve relentless calculations and theoretical work. This is clear from students' comments on the author's classes. Students' feedback/comments also show that they find the problem solving questions set on practical applications of the theories highly beneficial and engaging. This contributes to enhancing the social climate in teaching rooms. Students learn more effectively as they become relaxed and develop positive attitudes to the subjects.

A regular dialogue is maintained with students, through e-mails and the virtual learning environment, sending study materials and posting topics for discussion.

**Danny's Case:** Some characteristics Danny displayed are listed below:

- Showed a strong preference for a structured systematic approach
- Became easily distracted and anxious by any interruption or anything unusual such as a student coming in late and seating next to him/her
- Preferred to work on his/own and in silence
- Appeared unfriendly and got extremely irritated if any students or the author tried to talk to him/her especially when he/she was working on a question

These are commonly found in students with AS (Cambridge University, 2009). The author provides all students with a detailed class format providing guidelines about what to expect from classes and how to prepare for them in order to participate in class activities. This is an important aspect of her teaching approach designed to enhance student engagement and promote participation. Danny particularly benefited from having these details in advance as he stated that he liked the defined structure of class format.

Two weeks after teaching commenced the author received an email from him with a query about the online student registers. "... I think there is a slight error on it. It's only very minor, but I like things being accurate!" Students who have AS can be

intolerant of human mistakes which can be seen in Danny's reaction to the perceived error that actually worked in his/her favour and yet Danny wanted it corrected. The author had awarded him a grade higher than his actual grade shown on Danny's script, after seeing Danny's outstanding class work performance. This is in line with the author's procedure of amending actual grades if the class work on the same topic shows a remarkable improvement. This practice is explained to all students at the outset which encourages students to improve their work by engaging with problem questions in author's classes. Danny may not have clearly understood this and was satisfied when the author replied to his email explaining that she had amended his grade considering his impressive class work.

He preferred to work alone or with the author as opposed to engaging in group work and always insisted on sitting in the front row where he seemed most comfortable.

He found it highly distracting when late-comers sat next to him.

Danny did not like any changes to the author's class format he had got used to. This was effectively dealt with by the author who ensured that any changes were clearly explained to him and detailed guidelines provided.

There was a happy ending to this case and Danny performed well in the summative examination. The university disability office had allocated a quiet room for Danny which made all the difference.

### **The Outcome and discussion**

The author's approach has a positive impact on students' perceptions of the lectures and classes which is reflected in students' engagement, classwork, coursework and unprompted feedback. All students whose comments are included in this article are informed at the outset that their feedback/comments may be used for academic related purposes and have given their consent.

Qualitative feedback from students is very informative, as it highlights specific areas of the author' approach that students appreciated as below:

“Very enthusiastic teacher who truly cares about the well being of the students”

“...is indeed a teacher who is genuinely concerned about our work, which spurred us to work harder to improve ourselves.”

Further, acting more as a facilitator (someone who helps students solve problems, by discussing them and pointing students in the right direction) than a teacher (an

individual who imparts education/information to students) seems to have encouraged independent thinking, reflective skills and enhanced confidence which extended beyond the courses, as expected. The author allows students to work in the way that suits them best. She discusses problem solving questions with them pointing them in the right direction to help them solve questions themselves rather than providing them with correct solutions. This works well with the undergraduates who dislike prescriptive/imperative statements.

“She was very good at playing an enabling role – she didn’t just giving the solution, but steered us towards the solution by providing a clue as to where we might be going wrong. When you finally reached an answer it gave you more confidence in your own ability, as you knew you had actually worked all the steps yourself and resolved your problems with minimal teacher input.”

Formative assessments at the beginning of lectures/classes seem to have improved students’ perceptions of their individual progress making them receptive to the material covered.

“I like that you start the classes with the slides which are closely linked with the material covered on the lectures and home exercises, because it helps to revise the topics and keep up-to-date.”

“... is a great class teacher who offers good examples of the work covered....I generally enjoy classes and feel that the classes offer a relaxed environment which is excellent for learning.”

The following quote shows that the author’s aims of eliminating anxiety related to learning the subjects, promoting student engagement and enhancing student participation are fulfilled.

“I like that you are very friendly with students which excludes any tension during the classes and creates a stimulating environment with everyone involved.”

Problem solving questions on topics of students’ interest enhanced the learning climate in the teaching rooms, making it conducive to increasing student participation and engagement.

The discussed approach has improved students’ perceptions of mathematics and statistics courses taught by the author as reflected in their unprompted feedback, improved coursework standards and enhanced engagement. It has generally improved students’ attitudes towards the subjects and enhanced their engagement

with the courses. This is evident in excellent student attendance, students' positive comments on mathematics/statistics and enhanced commitment to classwork. Finally, students with specific learning differences require appropriate attention by well-informed academics willing to allocate additional time and effort to address specific guidance and support needs such cases may have. Danny benefited from the author's approach but it is crucial to be patient and considerate to behaviour patterns that may appear unusual to those unaware of the characteristics of students' with AS.

### **Conclusion**

The author's student centred teaching approach encourages all students to engage with learning mathematics and statistics, promoting inclusive teaching practice as hypothesised. This is evidenced by the students' commitment reflected in almost 100 % student attendance even in Fridays' 5pm classes and 100% classwork questions submissions/standards.

Teaching and learning activities focused on enhancing the students' learning experience promoted greater participation, and created a positive impact on students' perceptions of mathematics and statistics. This is evident in students' comments on authors' classes (Kotecha, M. 2012).

The author intends to continue to develop her research theme.

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# **Dyspraxia: the Silent Sister**

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This paper makes an account of dyspraxia within the context of disability history and the related discipline of disability studies. Here, I will interrogate the definition of the term dyspraxia and its origin within these fields and as part of what Henri Jacques Stiker (1997) in his *History of Disability* describes as 'the social modes of behaviour towards the out of the ordinary' (p. 13)

One key area to be addressed is whether dyspraxia can truly be said to have a history at all. If so, it is a recent one. Its role within traditional medical and social models of disability will be discussed. The perception of dyspraxia within the contexts of work, education and the family will also be addressed.

I will also suggest that my designation of dyspraxia as the 'silent sister' of dyslexia rests on the existing knowledge-base about the condition, which is primarily medical and needs to be expanded within a broader social remit and, in particular, at an individual level, particularly with regard to individual experience and self-narrative, recent trends in disability studies. Thus dyspraxia will be considered in relation to what Stiker describes as 'the mediating constructions and linkages' which have helped to shape definitions and perceptions of the condition (1997, 13).

Dyspraxia will also be analysed at an individual level, where the focus has traditionally been upon the so-called 'clumsy child', but which is increasingly considering the adolescent and the adult dyspraxic in the context of trends in self narrative research. Dyspraxic life-histories and personal voices will be explored in line with contemporary trends towards individually subjective studies of, say, dyslexia like David Pollak's (2005). This will allow for the consideration of the impact of the condition for the individual within a social context.

## **Defining Dyspraxia**

There is no denying the terminology surrounding dyspraxia is something of a minefield and this section may a little dense. However, it is necessary to frame the condition against the timeline of definitions against which it has evolved and consider which professional groups have invested in it.

The Dyspraxia Foundation defines dyspraxia as:

‘a impairment or immaturity of the organisation of movement’ which impacts on the brain’s ability to process information and enact functions connected with ‘perception, language and thought’

([http://www.dyspraxiafoundation.org.uk/services/dys\\_dyspraxia.php](http://www.dyspraxiafoundation.org.uk/services/dys_dyspraxia.php)).

The term dyspraxia originates from the word ‘praxis’, which means to ‘do/act’

([http://www.dyspraxiafoundation.org.uk/services/dys\\_dyspraxia.php](http://www.dyspraxiafoundation.org.uk/services/dys_dyspraxia.php)).

Dyspraxia appears to affect about 10% of the population and 2% of those severely; it is also four times more common in males and there seems to be a familial component and links to other spectrum conditions, such as dyslexia

([http://www.dyspraxiafoundation.org.uk/services/dys\\_dyspraxia.php](http://www.dyspraxiafoundation.org.uk/services/dys_dyspraxia.php)).

Drew discusses the definitional problems posed by dyspraxia, both in terms of naming the condition and identifying its characteristics (Brookes, 2005, p. 13; Drew, 2005, citing Ford, 1966). Grant (2005), in a similar vein, described dyspraxia as ‘similar to an iceberg...’ with visible and hidden components, the former being clumsiness and the latter centred upon attention, memory and perception (pp. 41-2).

Historically, like Asperger’s Syndrome, for example, the definition of dyspraxia is a relatively recent invention, first categorised in the twentieth century and described as ‘congenital maladroitness’ in 1900 (Brookes, 2005, p. 13; Drew, 2005, citing Cermak, 1985) In 1925, it was characterised as ‘motor weakness or psychomotor syndrome’(Brookes, 2005, p. 13; Drew, 2005, citing Orton, 1937). Orton, in the 1930s, defined it as ‘one of the six most common developmental disorders, showing distinctive impairment of praxis’, caused by ‘pyramidal, extra pyramidal or cerebellar dysfunction’ (Brookes, 2005, p. 13; Drew, 2005, citing Orton, 1937).

In the early 1970s, Ayres identified ‘developmental dyspraxia’ and linked this to sensory integration issues (Brookes, 2005, p. 13; Drew, 2005, citing Ayres, 1972/1979/1985). Gubbay coined the term ‘clumsy child syndrome’ in 1975 (Brookes, 2005, p. 13; Drew, 2005, citing Gubbay, 1975). By 1980, research was beginning to identify a range of different ‘forms of motor dysfunction’ in order to characterise the

condition (Drew, 2005, p. 2, citing David et al., (1981); Cermak (1985) and Sugden and Keogh (1990). In 1992, the World Health Organisation defined what it called 'Specific developmental disorder of motor function' (Drew, 2005, p. 2, citing WHO, 1992). In 1994, the term 'Developmental co-ordination disorder' (DCD) was coined (Drew, 2005, p. 2, citing DSM IV, APA, 1994).

There are a multiplicity of so-called 'soft-signs' indicating dyspraxia, commonly cited in checklists and guides to the condition, for example, the comprehensive example found in Mary Colley's (2000) self-help text, *Living with Dyspraxia*, which groups these within the areas of gross and fine motor skills, speech and language, eye movements, perception, learning, thought and memory, as well as emotional and behavioural components (pp. 17-20).

These areas relate to many of the problematic aspects of dyspraxia, such as clumsiness or being unable to ride a bicycle or drive, or play sport, poor handwriting, uncontrolled speech, light/noise sensitivity, poor sequencing and trying to do several things at once, difficulty 'reading' social signals', processing conversation, as well as impulsivity or anxiety (Colley, 2000, pp. 17-20) there are many other behavioural components of dyspraxia and not all diagnosed with the condition display all of these traits. This is why looking at individual experience is important, as it is these external behaviours lead to negative judgements and assumptions about the condition.

Research has not yet, to date, revealed a sole causal factor for dyspraxia and that its aetiology is 'unclear and heterogeneous' (Drew, 2005, p. 5). The 'soft signs' indicating dyspraxia are similar to those identified for dyslexia and include brain damage/dysfunction, poor information processing or environmental factors (Drew, 2005, p. 5). It is also stated that there is no cure for dyspraxia and whilst it may not be life threatening its statistical prevalence 'can be considered as a major public health concern' (Drew, 2005, p. 7; p. 11), given, as stated earlier, it is found in around 10% of the population.

Debate is still rife amongst practitioners as to the precise definition which encompasses Developmental Co-ordination disorder/dyspraxia, as, in many cases, the terms are used almost 'interchangeably', although DCD is seen to relate to 'the organization of movement and/motor planning' with gross and fine motor skills (Drew, 2005, p. 2). Occupational Therapy and Paediatrics favour DCD and Psychiatry and Psychology Dyspraxia, depending on whether the domains of impairment are physical or intellectual.

One problematic issue linked to the definition of dyspraxia is the range of terms used to describe it, listed in 1995 by Missiuna and Polatajko as including the terms: clumsy child syndrome, sensory integrative dysfunction, developmental dyspraxia and Developmental Co-ordination disorder (Drew, 2005, p. 2). Currently, 'developmental dyspraxia' and Developmental Co-ordination Disorder are the terms most commonly used to describe the condition in the United Kingdom and the USA (Drew, 2005, p. 2).

As with dyslexia, the application of 'various usages' to the condition by 'a diverse group of professionals' has muddied the definitional waters (Drew, 2005, p. 2, citing Peters et al, 2001). In this context, as Drew asserts 'the frequent name changes of the condition reflect an important issue, that the underlying reasons for motor-co-ordination difficulties' are '... still not fully understood' (Drew, 2005, p. 3).

Nonetheless, as Grant points out, to purely consider the condition in terms of individual physical clumsiness is to overlook how individuals may experience dyspraxia. In children such difficulties are very evident in the context of play and their other social interactions. Whilst most adults may have self-remediated these physical problems to some extent, there could still be problems (Grant, 2005, p. 42).

### **Dyspraxia and disability history**

We can now see from the previous section that dyspraxia was 'invented' in 1900 and is therefore only just over 100 years old. This section explores dyspraxia in relation to the fields of disability history and disability studies, in order to see whether, to draw a parallel with Lucien Febvre's *The Problem of Unbelief in the Sixteenth Century*, it, like atheism, as problematised by his research, could have existed in the cultural climate of pre-modern Europe.

Henri Jacques Stiker, in *A History of Disability* (1997) asks some fundamental questions, especially: 'why is disability called 'dis-ability?' adding...'and why so many categories?' (p. 3). Thus, through acquiring its 'dys' prefix, dyspraxia has already been assimilated into what Stiker characterises as 'the huge exercise in naming, that labelling that circumscribes one kind of reality' (1997, p. 3 as linked to variability 'dys' of 'praxis' (function)).

Each society thus has its own typology of difference and in pre-modern society, the Bible was a context which disability was perceived as a blemish which could prevent the afflicted from achieving proximity to God (1997, p. 24). Within classical cultures,

society recognised but could not accept 'alterity' and categorised manifestations of otherness within the realm of myths inhabited by gods and monsters (1997, p. 63). During the middle ages and the Renaissance, disability was perceived in a way that combined the Biblical and Classical cultural inheritance; on the one hand as a manifestation of divine displeasure and on the other, as evidence of the supernatural. For example, Winzer categorises 'deafness, mental retardation, insanity and epilepsy' as evidence of malign supernatural intervention (Winze, 1993, in Davis (ed.), 1997, p. 94). In other words, disability is an active presence in pre-modern culture, accounted for by acts of God and divine displeasure. But disability is visible rather than hidden.

Stiker is of the viewpoint that the hierarchical nature of medieval social order, subject to periodic inversion through devices like the carnival or the Feast of Fools, allowed such otherness to represent a form of social subversion (1997, p. 70). To quote Lennard Davis, in this context; 'the grotesque had life-affirming transgressive quality in its inversion of the political hierarchy' (Davis, 1995, in Davis, (ed.), 1997, p. 10). Winzer (1993, in Davis (ed.), 1997, p. 94) groups the disabled as having been at risk from the persecutory mechanism of the European Witchcraze, from its origins in the late 15th century until its final phase at the close of the eighteenth.

Furthermore, Stiker and Winzer both indicate a progression in European society, emergent from the sixteenth century onwards, towards a more humanistic world view, where charity, medicine, science and education made efforts to address some of the social issues presented by 'otherness' presented by disability (Stiker, 1997, p. 95; Winzer, 1993, in Davis, (ed.), 1997, p. 95). Stiker nonetheless asserts that a fundamental dichotomy governed social and cultural views of disability during this period, one that separated 'the universe of congenital deformity from that of inherent or acquired disability' (1997, p. 95). The key issues here are whether a condition was visible or hidden or whether only external behaviours were evident.

During the sixteenth and seventeenth centuries, in any of these above contexts, whether charitable, educational, medical or scientific, the view taken by those addressing disabling conditions in context, was very much what we would nowadays call a medical one, where expertise was deployed through interventions designed to 'solve' the problem they created. Within education, for example, this was evidenced by efforts by educators to teach the deaf to speak, as it was believed that this would

enable greater understanding of how human thought had evolved (Winzer, 1993, in Davis, (ed.) 1997, p. 100).

Despite what we might, from a progressivist stance, determine to be what Winzer has called 'a new, emergent attitude toward exceptionality' (1993, in Davis, (ed.) 1997, p. 106) the eighteenth and nineteenth centuries still used rehabilitative models to address disability (Stiker, 1997, p.125). These involved medicalisation and institutionalisation in order to solve the problems which such conditions presented within society.

To move the debate forward and to focus on the early modern and modern British context, Anne Borsay has, in her book *Disability and Social Policy in Britain since 1750. A History of Exclusion* (2005) explored the relationship between disability and its social context. In her words, 'disabled people's experiences of exclusion have to be assessed with reference to a 'moving frontier in a mixed economy of welfare' (p. 3). Her view is that the disabled in Britain have been marginalised in relation to social and economic policy and that 'a threadbare patchwork of services' have been deployed in order to promote them, but which in fact have served to exclude them, whether these be workhouses, asylums or care in the community (2005, p. 6).

In social terms, reaction to disability still makes a distinction between the hidden and the visible. Acquired conditions are easier to accept than the hidden, if one considers Paralympic publicity for physically affected athletes, as opposed to those with, say Mental Health Conditions. The hidden is still harder to account for, assimilate and understand. Behaviours which indicate so called 'hidden' conditions often stigmatise the individuals who have them, such as being clumsy due to dyspraxia.

So where does this leave dyspraxia and its emergence in 1900? How can we make it visible in history? Winzer (1993, in Davis (ed.), 1997, p. 80) makes a point which may partially account for the invisibility of dyspraxia in history. She comments; 'Given the social and occupational requisites for survival in early societies, some groups that we so assiduously label and classify today were not even recognised as the logical or deserving recipients of social or legal concern' (p. 80). In her view, in pre-literate society, what she styles the 'mildly intellectually disabled...would simply have merged into the general populace' (1993, in Davis (ed.) 1997, p. 80). This might apply to dyslexia but I am not so sure about dyspraxia, as if the main prerequisite in pre-literate society was effective physical function, it could have been more evident than we give it credit for; but this is speculation on my part.

Let us return once again to the prefix 'dys' which I think explains some of these questions; this intimates non-praxis, non-function. Early definitions of dyslexia used the terminology of 'word-blindness'; thus an existing typology, here blindness was deployed to account for literacy problems that were not accounted for by so-called 'normalized' definitions of intelligence embodied by IQ tests (Davis, 1994, in Davis (ed.), 1997, p. 16). A parallel link has thus been made to connect non-praxis and function with the creation and definition of dyspraxia; in other words, we have had to use traditional models of physical disability to account for its existence and describe its characteristics.

### **Disability Studies and dyspraxia**

Disability Studies is a relatively recent area within academic studies, but its emergence is evidence of how traditional, negative constructions of disability have been progressively challenged (Johnstone, 2001, p. 1). This applies to dyspraxia. Key debates within the discipline focus upon the labelling and stereotypes, as well as the stigmatisation associated with disability (Johnstone, 2001, 6-9). It looks at how definitions of disability impact upon social and political policy (Johnstone, 2001, p. 10). It also argues for the case for reconstructing the 'language of disability' away from negative stereotypes towards more inclusive ones (Johnstone, 2001, pp. 11-13). The movement for equality amongst and by disabled people is also charted within disability studies, as well as the outcomes of inclusivity legislation upon social and political trends (Johnstone, 2001, p. 14). Within this field, the medical and social models are also extremely important in creating the paradigm shift away from passivity and difference towards social inclusion and integration, towards more affirmative and rights based models (Johnstone, 2001, p. 22).

Policy plays a part here. The 1970 Education Act, 1994 Salamanca Agreement and the emergence of the Disability Discrimination Act, Special Educational Needs and Disability Act and the Equality Act (2010) are all supposedly indicators of the positive acceptance of 'protected characteristics' in society and education. However, individual life experience often suggests otherwise, as discussed in the next section. Debates and principles which govern disability studies apply equally in the case of dyspraxia. Dyspraxia, as with other disabilities has its apologists and campaigners, who strive to present the condition in a positive light. A good example of this approach is to be found in Colley's book, *Living with Dyspraxia*, which highlights its

'positive strengths and skills' associated with the condition, such as creativity, determination, originality, empathy, intuition and perseverance (2000, p. 20).

### **Dyspraxia and social contexts: the family, education and work**

We have seen already how disability studies use the social model as a vehicle to foster inclusion within the contexts of the family, education and employment, as well as in relation to leisure and social environments (Johnstone, 2001, p. 21). This model has limitations due to the varied nature of individual conditions but the fundamental holds good in relation to dyspraxia, for as we will see in the following section, these are all contexts occupied by dyspraxic people and in which, to varying degrees, they can experience difficulties (Johnstone, 2001, p. 21).

### **Individual contexts; the life history approach: life stages**

Mark Priestley argues that using the 'life course' approach to consider disability 'avoids an over simplification of disabled people's collective experiences' (2004, in Swain et al, 2004, p. 94). This view holds good in the case of dyspraxia, as Grant comments that being dyspraxic is a matter of lifestyle, as it impacts on everyday life in many ways; he also advocates how important hearing individual dyspraxic testimonies can be to shaping our developing understanding of the condition (2005, pp. 2-3).

### **Childhood**

Childhood is the life-stage of dyspraxia has been addressed in most detail by a range of practitioners from psychologists to Occupational Therapists, such as Sharon Drew. As John Davis states, 'disabled children/young people are a diverse group' and dyspraxic children are no exception (2004, in Swain et al, 2004, p. 142). Yet, the impact of the hidden disability which is dyspraxia can impact significantly upon children's education, physical activity and social interaction or inclusion is often very negative. Geoff Brookes quotes one child who stated; 'I am able bodied. I have full use of my arms and legs. I am not a freak. I am not confined to a wheelchair' (2005, p. 19).

The perspective from which dyspraxia in children is addressed is based on developing better understanding of the condition in order to assist children in becoming better included and to avoid the potential for anxiety and poor self-esteem which can otherwise present. This can partly be addressed through external

remediation such as Interventions by Occupational Therapists. Education is the key context, in the view of Geoff Brookes, where the needs of dyspraxic children can be most effectively addressed (2005, p. 101).

### **Adolescence**

Given the range of difficulties which dyspraxia can present at an individual level, adolescence is a life stage where these can be very apparent. Part autobiography, part self-help guide, Victoria Bigg's book *Caged in Chaos* (2005) describes her experiences with humour and insight. She describes dyspraxia in terms of a recipe which creates a 'bittersweet dish' mingling 'bullying, low self-esteem and lack of awareness, with 'understanding, patience, support and laughter' (p. 12). Her book is useful for characterising individual experience and suggesting strategies to address issues in the context of school, the family and education.

### **Adulthood**

As discussed in relation to work by Sharon Drew, David Grant and Mary Colley, dyspraxia can also impact significantly upon adult life-tasks and social interaction. All these authors address the condition from the positive perspective of self-help and social integration, designed to assist the individual with the process of individual and social acceptance, whilst acknowledging areas of difficulty they might experience. Drew uses a diagram to indicate parallel life experiences of a successful and unsuccessful dyspraxic adult, where personal and external factors like intelligence or social background can literally make the difference between success or failure (Drew, 2005, p. 23).

Werenowska's collection of experiential writing by adult dyspraxics 'highlights the common features of dyspraxia and society's response to the condition' from the perspective of individual experience (2003, p. 5). This collection is important and useful for characterising the condition in relation to how individuals experience it, reminding us that there is no such thing as a 'typical' dyspraxic. As Charlie Bee, aged 21 comments; 'I am me and dyspraxia is a part of who I am. It may win some battles, but I will win the war (Werenowska, 2003, p. 14).

### **Conclusion:**

Future directions for history of dyspraxia in history and disability studies

Conceptually, dyspraxia is still finding its place within the fields of disability history and disability studies, and within a complex social and cultural context.

In this way, it has not progressed as far even as dyslexia, which now has the dubious merit of being an 'invented' condition in current realms of debate.

Borsay argues that society needs to move away from the 'passive...tragic assumptions' of the 'individual' medical model of disability towards a collective political, economic and social one (2005, p. 207). Within this, attitudes towards disability need to be 'open to change' and in this context, dyspraxia is no exception (Borsay, 2005, p. 207).

To conclude, with a quote from Geoff Brookes, 'The condition is a real one, with a history and certainly with a future' (2005, p. 1). How we shape this future is partly down to dyspraxic individuals, whose personal and collective experiences have informed our awareness of the condition, and partly down to the way in which society addresses their future needs.

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### **Electronic resources**

[http://www.dyspraxiafoundation.org.uk/services/dys\\_dyspraxia.php](http://www.dyspraxiafoundation.org.uk/services/dys_dyspraxia.php), accessed 18/06/07

# Updating the evidence of the impact of SuperReading on dyslexic students

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## Abstract

This paper reports on the emerging evidence that SuperReading, a short two month course developed by Ron Cole, dramatically increases the reading effectiveness of dyslexic students in Higher Education. The measure of reading effectiveness (RE) is produced by combining speed (words per minute) with percentage comprehension/recall scores. It is found that mean scores of dyslexic students (n=152) increase dramatically, exceeding the scores of non-dyslexic readers. The reading tests have been standardised with a sample of non-dyslexic readers (n=316 - mainly teachers, lecturers and support tutors in HE). The increase in standardised RE scores of dyslexic SuperReaders is 1.75 standard deviations and the statistical significance is extremely high. This may be unprecedented.

The positive feedback from dyslexic readers, some of which is quoted here, also supports the view that SuperReading makes a dramatic difference to reading effectiveness, study skills, self-confidence and self-esteem.

## Background

An evaluation of the impact of a SuperReading course with 15 dyslexic adults undertaken in 2008 was published in the Journal of Inclusive Practice in Further and Higher Education (Cooper, 2009). Twelve of the dyslexic adults were students in higher education and three were dyslexic members of staff at LLU+, London Southbank University. As a dyslexic researcher and participant, I was able to report on my own experience as well as the reading scores of the group.

Ron Cole, who developed SuperReading, had claimed that if participants practiced the 'eye-hop' reading exercise for 40 minutes a day for the duration of the course, reading effectiveness (measured by speed x comprehension/recall) would double in

two months. The pilot research surprisingly confirmed this claim. He had also observed that dyslexic participants appeared to benefit more than non-dyslexic participants and was interested to test this observation more carefully. We were surprised to discover, that those readers with the most difficulty reading nonwords made the most progress. This may suggest that the course developed reading excellence by building on dyslexic holistic and visual strengths, rather than attempting to remediate a perceived phonological 'deficit'. In addition, sight recognition of words (measured by the Test Of Word Recognition Efficiency [TOWRE]) increased by a mean of 7 standardised points. SuperReading focuses on words in combination, so this result was also unexpected.

A T-test confirmed that the statistical significance of the improvement of reading effectiveness (RE) was high ( $p < 0.001$ ). As the sample was small, this can be explained by the large impact. This pilot research encouraged us to investigate further. Since 2008, we have recorded all the first and last reading test scores of all dyslexic participants ( $n=152$ ) on SuperReading courses.

We have also standardised the reading tests with non-dyslexic readers ( $n=316$ ). Finally, we have used the same reading tests with 11 volunteers over the same time period of two months (without benefit of an intervention). This paper reports on these results. It is not clinical research, but action research which includes both qualitative and quantitative results.

In brief, the SuperReading course involves six half-day taught sessions spread over two months. Participants are taught to develop better visual absorption of meaning through the 'eye-hop' reading exercise, a practical approach to metacognitive reading strategies, and a memory strategy to improve recall.

Metacognitive reading strategies have long been known to improve understanding and recall of text (Wray, 1994). In brief, previewing and questioning texts, as well as reviewing what has been read can be taught and have been shown to be beneficial. Such strategies form an important part of expected 1:1 support strategies. However, we will see that SuperReading provides an effective group intervention that not only enables a practical approach to such strategies, but also demonstrates their value. In addition, the peer support provided by the group helps to maintain the intensity of practice needed to reach a threshold of skill. This is often absent from 1:1 support. This paper presents the statistical evidence as well as examples of feedback provided by dyslexic participants on SuperReading courses.

## **Improving Reading Speed**

The eye-hop exercise is designed to gradually increase the visual absorption of meaning for larger numbers of combined words. This starts with two at a time and progresses to 5, or more, at a time. This increases the speed at which good comprehension can be maintained when 'reading'.

However, the ability to maintain good comprehension at high speed also depends on previewing the text, so that the reader is aware of what is coming up and evokes prior knowledge and a more explicit awareness of why the reader is reading the text. SuperReading provides a range of previewing strategies to enable this.

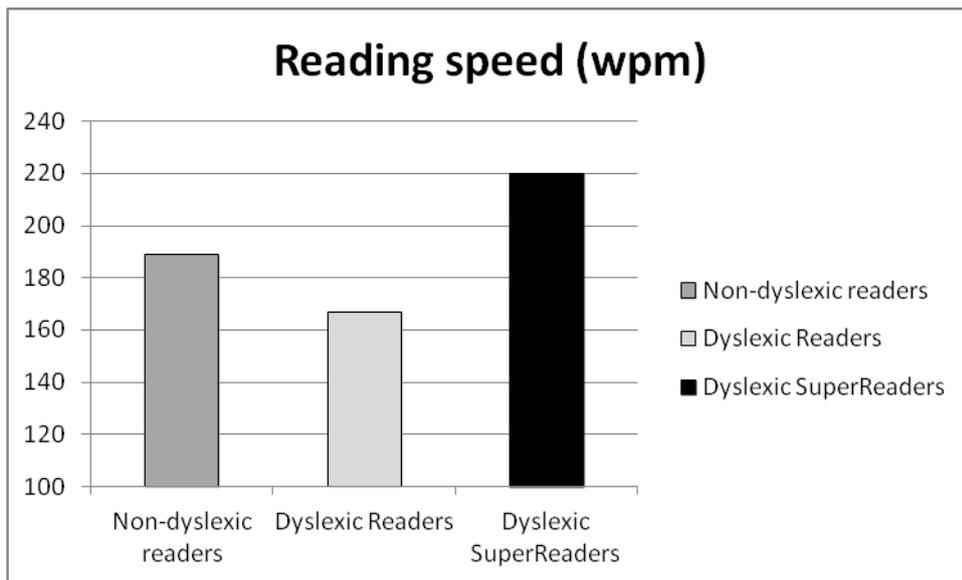
Reading speed is first measured by asking participants to read a text of 400 words as fast as the reader can while trying to ensure good comprehension. The speed is measured and recorded as words per minute (wpm). The mean speed of non-dyslexic readers on our tests is 189 wpm (standard deviation [SD]=56 wpm).

Reading speed depends on a wide variety of factors including perceived difficulty, purpose, interest, motivation, prior knowledge, and energy levels. In this case, the readers are aware that they will be tested on their knowledge of the text. This is likely to slow the reading speed down compared to tests of reading speed which simply ask the reader to read. This is likely to be the reason that the speeds reported here are slower than those often quoted for students' (e.g. HE Working Party- "There is an expectation that undergraduates should be able to read silently at 250 words per minute.").

In this paper, I am reporting on all the students' scores whether or not they managed the recommended 40 minutes a day practice. (In fact most did not. On interviewing the students, it would appear that on average we managed 20 minutes a day).

However, it appears clear as a SuperReading coach that those who practice the most make the most gains in reading effectiveness.

The mean speed of dyslexic readers has been measured as 167wpm (or 22wpm slower than non-dyslexic readers). At the end of the SuperReading course, the mean reading speed of dyslexic SuperReaders is 220wpm (or 31wpm faster than non-dyslexic readers).



**Fig 1: Comparing Mean Reading Speeds (in words per minute).**

Mean scores provide useful comparisons, but when the distribution is not completely symmetrical, medians can provide a more useful perspective. Median scores are the score in ‘the middle’, which have an equal number of individual scores both above and below it. In this way, we can identify a more ‘representative’ score, undistorted by individual extremes. The median reading speed of non-dyslexic readers is 178wpm. The median reading speed of dyslexic readers is 163 wpm (or 15 wpm slower). The median reading speed of dyslexic SuperReaders is 216 wpm (or 38 wpm faster).

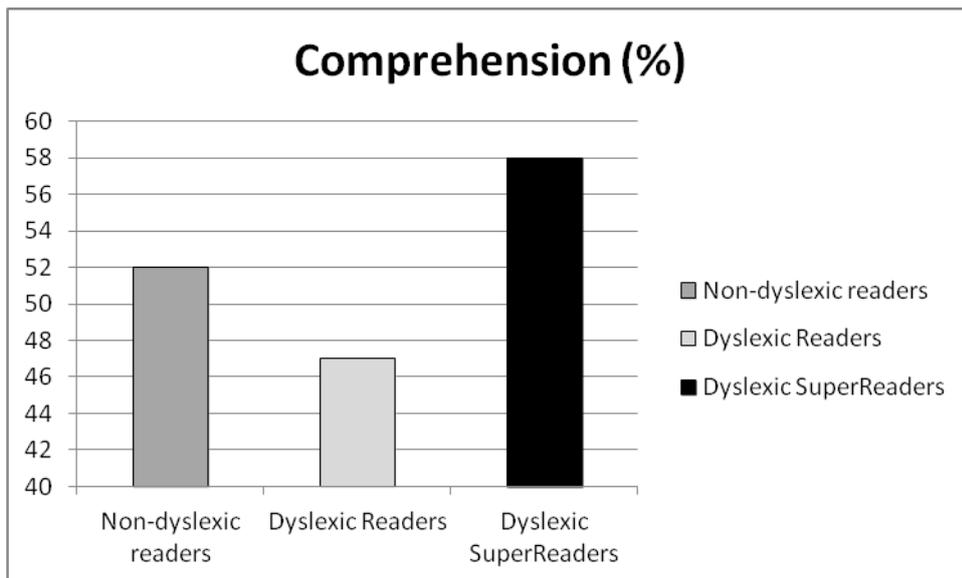
“My reading speed is far quicker and so I have been able to complete my work far more efficiently.”

“It did make a great difference in my reading speed. I have surprised myself about how quicker I can read a text now.”

### **Comprehension**

Comprehension is tested by asking 10 questions directly related to the test text (to reduce the variable impact of prior knowledge). When trying to answer the questions, the participants are given no access to the text to ensure that the knowledge is ‘recalled’ rather than simply relocated.

The mean comprehension of non-dyslexic readers has been measured on these tests as 52% (SD=22). The mean comprehension of dyslexic readers has been measured as 47% (or 5% lower). At the end of the SuperReading course, dyslexic SuperReaders achieve a mean of 58% (or 6% higher).



**Fig 2: Comparing Mean Reading Comprehension**

The median comprehension of non-dyslexic readers has been measured on these tests as 55%. The median comprehension of dyslexic readers has been measured as 50% (or 5% lower). At the end of the SuperReading course, dyslexic SuperReaders achieve a median of 60% (or 5% higher).

"I approach books and journals with the knowledge that I can read them, and it makes the whole experience more enjoyable."

### Reading Effectiveness

SuperReading courses stress that there is little point in reading faster at the expense of comprehension. What really matters for reading effectiveness is that both comprehension and speed increase. One of the tools through which this is achieved is ensuring that participants preview the reading tests. They are asked to preview for up to 30 seconds before reading, and the time taken to do so is included in the wpm calculations. This demonstrates to participants that previewing saves them time.

Previewing enables a faster reading speed because the reader knows what is coming up. It also improves comprehension and recall because key information is being taken in twice.

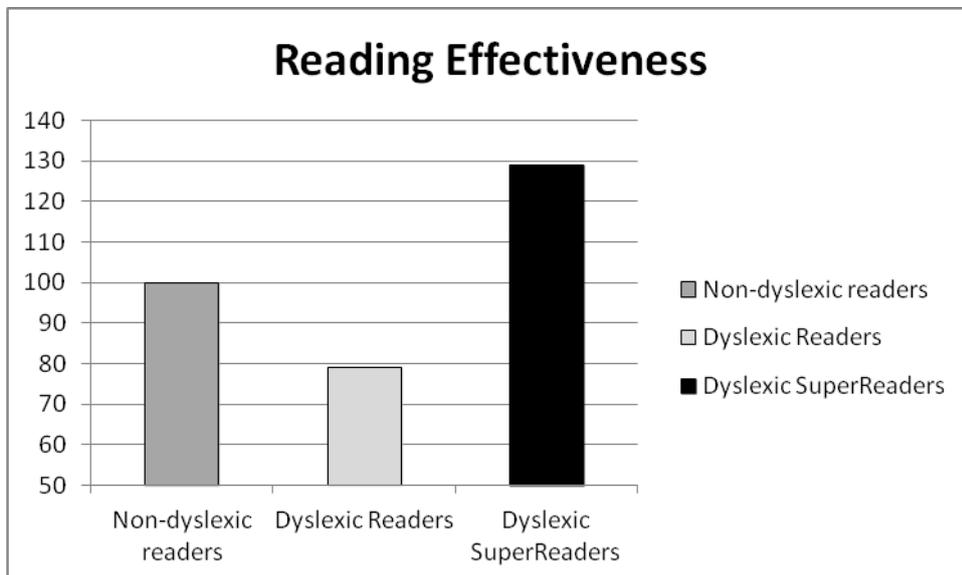
Reading Effectiveness (RE) is measured through multiplying the wpm (which now includes the previewing time of SuperReaders) with the comprehension score (e.g. 200wpm x 50%= 100RE).

It is usually evident during the initial tests that both dyslexic and non-dyslexic readers rarely preview the tests. But they learn to do so through SuperReading courses. It is an interesting observation to me that although I had taught dyslexic readers to preview in 1:1 sessions, I rarely if ever previewed reading material myself, despite my own dyslexia. This was because I believed that I did not have the time to do so. SuperReading has demonstrated to me its value to effective reading.

The mean non-dyslexic Reading Effectiveness (RE) score is:  
(189 wpm x 52%) = 100 (RE). [SD 52]

The mean dyslexic RE score is:  
(167 wpm x 47%) = 79 (RE).

Whereas, the mean dyslexic SuperReading RE score is:  
(220 wpm x 58%) = 129 (RE)



**Fig 3: Comparing Mean Reading Effectiveness**

If we consider the median scores, then the non-dyslexic median RE score is 93. The dyslexic median RE score is 72 whereas the dyslexic SuperReading median RE score is 122.

We can put these scores in context later by comparing standardised scores and the statistical significance of the progress made.

The student experience is not just of faster reading with better comprehension, but of better concentration:

“Because I am able to read quicker I am far more focused and able to work for longer.”

“I don’t fall asleep as quickly from reading and am less tired from it.”

### **Reading Review**

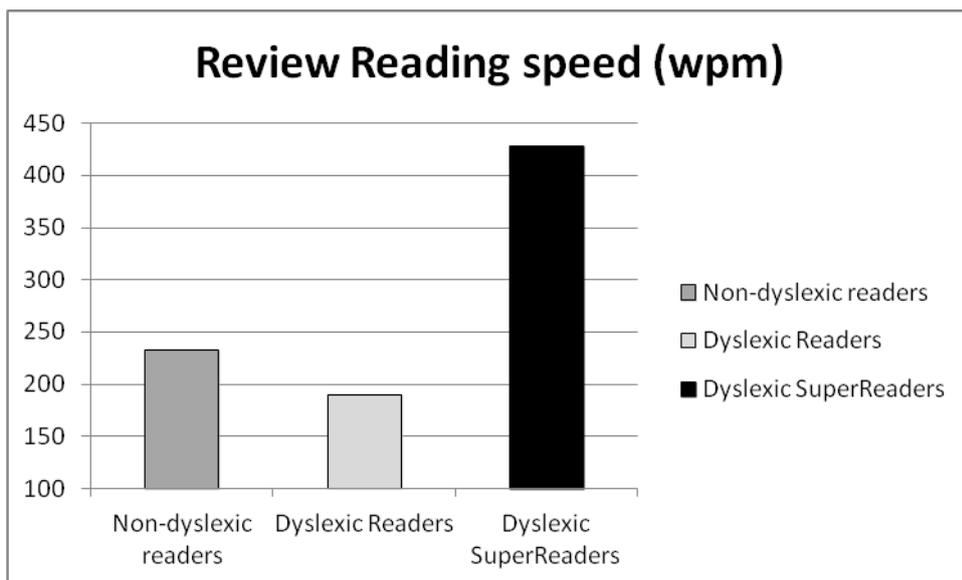
Part of good metacognitive reading strategy is to review what you have read, particularly when a thorough understanding and recall of the material is required. Teaching this is an important part of the SuperReading course. It demonstrates the importance and value of reviewing, and how much difference it makes to comprehension and recall.

After the reading test, participants are asked to review the same text in an effort to achieve 100% on the same set of questions. The time taken is measured.

The mean review speed of non-dyslexic students, expressed as wpm, is 233 wpm [SD=93].

The mean review speed of dyslexic students is 189 wpm (or 44 wpm slower).

The mean review speed of dyslexic SuperReaders is 428 wpm (or 195 wpm faster- NB this is more than two standard deviations above the non-dyslexic mean score).



**Fig 4: Comparing Mean Review Reading Speeds (words per minute)**

If we consider the median speeds we find that:

The median review speed of non-dyslexic students, expressed as wpm, is 212 wpm.

The median review speed of dyslexic students is 178 wpm (or 34 wpm slower).

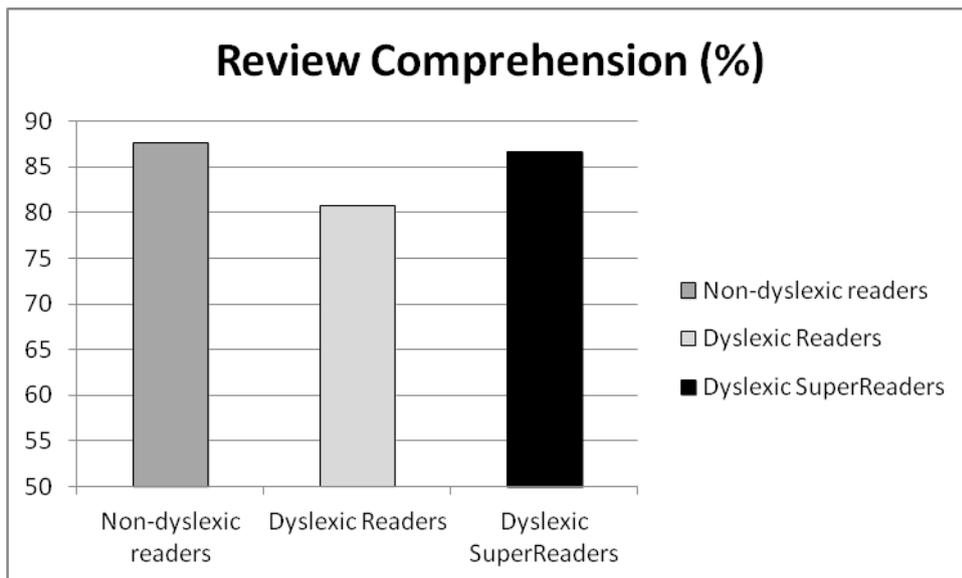
The median review speed of dyslexic SuperReaders is 353 wpm (or 142 wpm faster).

### Review Comprehension

Readers are asked to answer the same 10 questions without being able to look at the text, or their first set of answers. This is intended to measure what comprehension has been retained and recalled. Students are often surprised by how much better their comprehension is after reviewing the test material.

“I used to find it difficult to understand what I read, but now I really ‘get it.’”

The mean review comprehension of non-dyslexic readers has been measured on these tests as 87.7% (SD=14). The mean review comprehension of dyslexic readers has been measured as 80.8% (or 6.9% lower). At the end of the SuperReading course, dyslexic SuperReaders achieve a mean comprehension of 86.6% (or 1.1% lower).



**Fig 5: Comparing Mean Review Comprehension (%)**

The median review comprehension of non-dyslexic readers has been measured on these tests as 90%. The median review comprehension of dyslexic readers has been measured as 85% (or 5% lower). At the end of the SuperReading course, dyslexic SuperReaders achieve a median score of 90%.

“I now feel more positive towards upcoming work as it seems far more achievable.”

Review Reading Effectiveness

SuperReading participants are taught strategies to review at greater speed to maximise reading effectiveness. Increases in review scores are particularly dramatic.

The mean non-dyslexic Review Reading Effectiveness (RRE) score is:

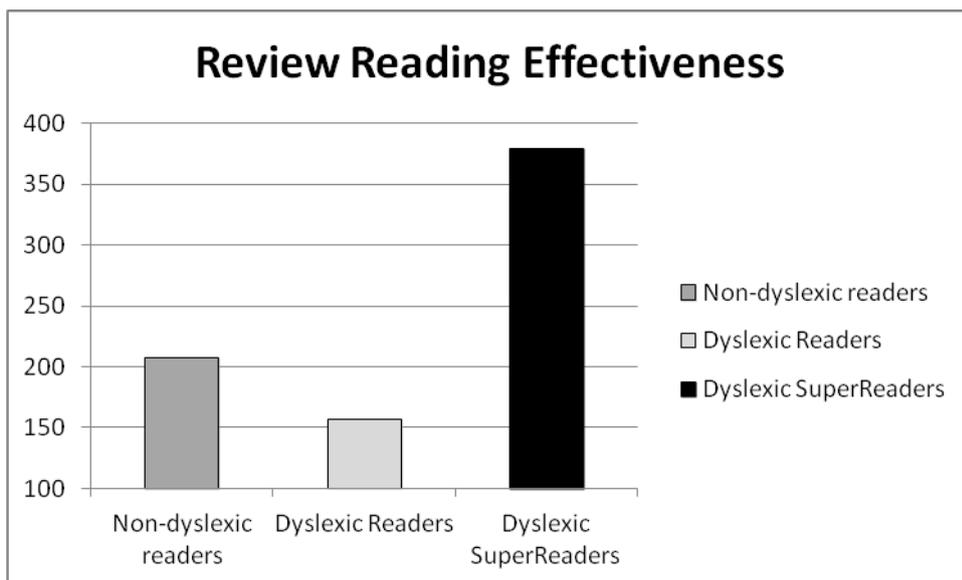
$(233 \text{ wpm} \times 89\%) = 207 \text{ (RRE)}$ . [SD=98]

The mean dyslexic RRE score is:

$(189 \text{ wpm} \times 81\%) = 157 \text{ (RE)}$ .

Whereas, the mean dyslexic SuperReading RE score is:

$(428 \text{ wpm} \times 87\%) = 379 \text{ (RE)}$  (This 1.75 SD above the non-dyslexic mean)



**Fig 6: Comparing Mean Review Reading Effectiveness**

If we consider the median scores, then the non-dyslexic median RE score is 187. The dyslexic median RE score is 145 whereas the dyslexic SuperReading median RE score is 312.

“I have a long commute to college and used to read one academic article each way, four times a week i.e. 8 articles. Now I read at least two articles each journey, 16-20 articles a week. That’s my whole reading assignment per week sorted on my commute! Thanks a million.”

### **Making sense of the raw scores**

We can see that with the exception of the review comprehension (which is subject to a ceiling effect), all the dyslexic SuperReading scores exceed the non-dyslexic scores. This is surprising in itself. However, to make consistent comparisons, we have standardised all the scores.

SuperReading is designed to increase speed and comprehension simultaneously. However, we recognise that there is usually a relationship between speed and comprehension; generally, increased speed tends to reduce comprehension.

Similarly, when we wish to understand text better, readers tend to slow up.

Consequently, the RE measure (speed x comprehension/recall) is designed to measure reading effectiveness progress while ignoring the specific changes in either speed or comprehension. We therefore focus on this when making comparisons.

The standardised scores have been derived from a sample of 316 readers. Ideally, this should be a random sample. However, our sample depended on accessing willing volunteers. Consequently, it consists primarily of dyslexia support tutors, who we might expect to have better than 'average' reading effectiveness skills. I have also excluded everyone from the sample who was known to be dyslexic. This is because, a significant sub group of tutors attending my awareness sessions are dyslexic and I wished to avoid overbalancing the sample with dyslexic readers. This also would have the consequence of raising the standardised scores, since we would normally expect around 5-10% of a random sample to be dyslexic.

In the same way that speed and comprehension interact and need to be considered together, it is also the case that reading effectiveness (RE) and review reading effectiveness (RRE) similarly interact. For example, if a reader takes a great deal of time reading to understand and retain full comprehension of a text, it is likely that they will need less time to review for full comprehension (and vice versa). For this reason, we also measure 'Combined Reading Effectiveness' (CRE) which is based on the total time taken for the final comprehension.

The mean standardised scores for reading effectiveness (RE), review reading effectiveness (RRE) and combined reading effectiveness (CRE) are reported in this table:

	Standardised RE	Standardised RRE	Standardised CRE
Non-dyslexic readers	100	100	100
Dyslexic readers	94	92	91
Dyslexic SuperReaders	108	126	116

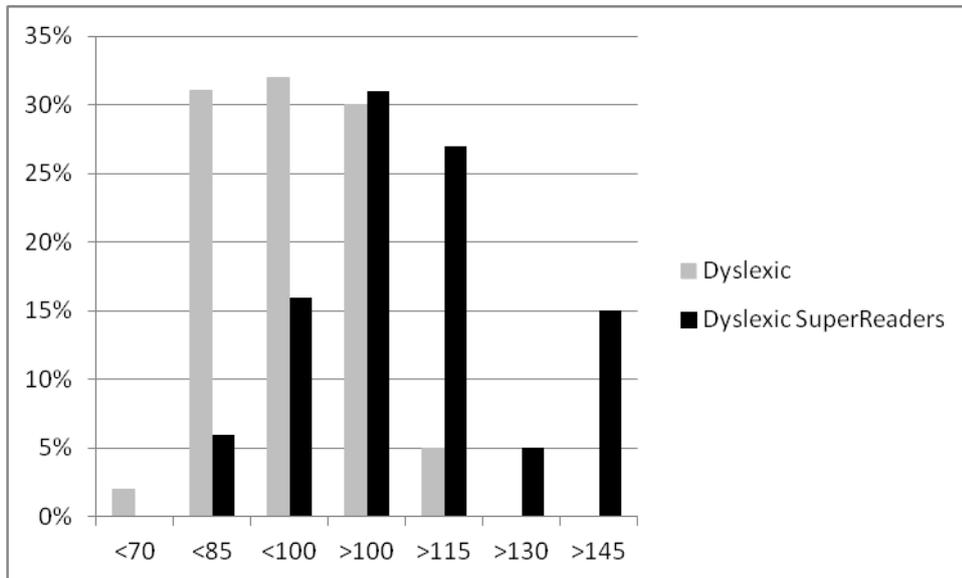
RE scores increase by a mean of 16 standardised points (1.07 standard deviations)

RRE scores increase by a mean of 34 standardised points (2.27 standard deviations)

CRE scores increase by a mean of 25 standardised points (1.67 standard deviations)

A more nuanced way of articulating this dramatic progress is by reporting the distribution of standardised scores. In this graph we can see the distribution of dyslexic readers' standardised CRE scores at the start of a SuperReading course (grey columns) and the same dyslexic readers' distribution of standardised CRE

scores at the end of a SuperReading course (black columns), divided into 7 standard deviations.



**Fig 6: Comparing the Distribution of Standardised Combined Reading Effectiveness Scores for Dyslexic Readers before and after SuperReading.**

The dramatic shift from below the mean (<100) at the beginning of the course to above the mean (>100) at the end of the course is clearly evident. You can also see that a much higher proportion of dyslexic SuperReaders than might be expected achieve extremely high reading effectiveness scores (15% score above a standardised score of 145 when we would expect only 0.1% of the general population to do so).

Some students report that despite initial scepticism, they are now sure they are better readers:

“I approached the course with a degree of scepticism, but I soon found that my speed of reading was improving and also my approach to reading.”

"SuperReading has definitely helped me more than I thought it would. It has introduced me to new techniques that have helped in my studies and got me back into reading novels in my free time, which I hadn't done for over a year,"

### **Standardising RE scores**

As stated earlier, the number of non-dyslexic readers to have undertaken a reading test is currently 316. This is a reasonable sample to estimate standardised scores. However, we continue to increase the sample at every opportunity. Standardisation

of the scores has been done with Excel, which provides statistical formulae for estimating standardised scores and standard deviations. These have changed only very marginally after we exceeded a sample of 100. Excel also facilitates a calculation of statistical significance through a T-test. This has increased dramatically as the sample of dyslexic SuperReaders increased.

The statistical significance of the increases in:

- reading speed
- comprehension
- reading effectiveness
- review speed
- review comprehension
- review reading effectiveness
- combined reading effectiveness

are now all considerably greater than  $p < 0.001$ . The smallest statistical significance is for the increase in review comprehension ( $p < 0.0001$ ). The greatest statistical significance is for the progress in combined reading effectiveness (less than one chance in one hundred thousand million, million, million, million, million that it would happen by chance). In effect, the statistical significance of the progress have achieved astronomical proportions.

### **Quasi-control group.**

It is extremely clear from the statistical analysis that the progress achieved through SuperReading needs an explanation, since these results cannot have happened by chance. One possible explanation was that practicing the tests improves performance. This possibility was examined early on in the analysis of SuperReading. We asked for volunteers to take the reading tests under the same test conditions over the same time period as the dyslexic participants. Eleven were forthcoming.

As participants on SuperReading courses do not attend every session, we calculated that the average number of tests taken by participants is 5. The volunteers therefore took 5 tests with two week intervals between them.

It soon became evident that this group of volunteers were good readers (which may have been a factor in their volunteering). Their mean RE score was 146 (81st percentile) falling to 124 (68th percentile) and their Review RE score was 283 (77th percentile) falling to 274 (75th percentile). It could therefore be argued that this was not a very representative sample, and that a ceiling effect could be a factor in a complete lack of progress.

In practice, we found that individual combined reading effectiveness scores varied by up to 50% compared to the first test (which suggests a ceiling effect is not a significant factor). When we took the mean of their reading and review speeds and comprehension scores we found that all the scores remained remarkably stable:

Mean reading speed decreased by 8.6%

Mean reading comprehension decreased by 7%

Mean review speed remained exactly the same.

Mean review comprehension decreased by 3.3%

In addition, we found that the mean dyslexic RE scores at the end of the SuperReading course generally exceed these high scores. The dyslexic SuperReading RE score is 129 (70th percentile), while the mean Review RE is 379 (96th percentile).

It would be difficult to argue that practicing the test, despite this evidence to the contrary, does not improve performance to some degree. Another possible explanation for the lack of evidence for this increased skill for the quasi-control group is that test fatigue may offset any greater skill acquired. Nevertheless, the evidence is unable to support the view that test practice can explain the dramatic increases in test scores. This therefore lends weight to the conclusion that the SuperReading course is responsible for the excellent progress achieved

"SuperReading has helped me to develop confidence in my memory skills. It has also made me think that I am no longer a 'slow reader'. I have more confidence in my ability to read faster and understand the text."

"It's been an amazing experience....I cannot say exactly how and why but I feel the beginnings of a liberation which goes beyond reading."

## **Conclusions**

SuperReading provides a complex set of reading skills and tools, and changes attitudes to reading. Our experience of the course suggests that the most important of the strategies is the 'eye-hop' exercise. We experience that those participants who practice a lot, and we can see in the classroom getting a higher level of skill with eye-hopping, make the most dramatic progress in the reading tests. In contrast, those who practice very little, make little progress with their reading effectiveness. However, the motivation and commitment needed to practice cannot be meaningfully separated from other aspects of the course; such as the memory techniques which can be seen to improve self-esteem and confidence, or from 'softer' support such as peer support which helps to maintain daily practice.

"As a working professional reading took up too much of my time which could have been used elsewhere. I found it frustrating and embarrassing....I am more at ease with my reading ability, therefore able to carry out tasks at work quicker and more efficiently. The memory room also allows me to carry information in my head rather than on scraps of paper which I lose!"

We are also aware that the metacognitive (holistic) approaches to reading seem to make sense to dyslexic learners. The visualisation and visual approaches to absorbing meaning are a good fit with dyslexic strengths. We suspect that it is these that result in particular benefit to dyslexic readers. There is also no attempt to 'remediate' any perceived 'deficit', which can feel demeaning and frustrating and in this way undermine progress. In contrast, students report that reading has moved from a chore to a pleasure:

"Personally it has given me my love of reading, which has improved my home life immensely.

"Since starting I have finished 3 novels!"

"I now find it easier to read for pleasure- it used to be a bit of a will power exercise before- now it's more of a pleasure."

"I have enjoyed the course and have started to read more instead of thinking reading is a chore."

The fact that 8 out of 10 dyslexic SuperReaders achieve reading effectiveness scores that are higher than their tutors (mean CRE is in the 86th percentile) demonstrates that there is no need for dyslexic readers to struggle with reading. Rather, dyslexic readers can be excellent readers.

"It has helped me to improve my reading speed, comprehension and most importantly confidence."

Students themselves report on an improved quality of life:

"The course has significantly improved my life, both personally and professionally."

"It has truly changed my life."

"It has actually been exciting and to see a skill that one can build on is rather exciting. It has made reading much more liberating."

"A worthwhile experience. It improves the quality of life when so much information is in the written world."

"It's not often that you can say that a course has changed your life."

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# **How AT-based specialist SPLD support strategies are more effective when meeting the student's point of need in the context of the Disabled Students Allowance Scheme**

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## **Introduction**

This project aims to investigate how the use of an AT-based programme listing strategies under the same schema as is used in the current assessment of need report format (the five headings: Research, Composition, Proofreading, Note-taking and Time Management) is more effective in the context of specialist support sessions meeting the student's current point of need.

The underlying methodology relies on data collected from: student's diagnostic assessment and assessment of need; structured and unstructured interviews with the student; observation of his listening and learning strategies over multiple one to one specialist support sessions; student feedback during and after student support sessions; and a review of related literature. This methodological triangulation is an attempt to "explain more fully, the richness and complexity of human behaviour". (Cohen and Manion, 2000).

The support provided will build on the student's existing strategies; use a schema and list of strategies firmly grounded in the reality of the academic tasks he is required to undertake; use a scaffolding approach with respect to teaching practice; re-frame his existing approach to using software when undertaking academic work; and empower him to come a step closer to producing coursework commensurate with his underlying ability with a concomitant improvement in his self-esteem. In this case study, the re-framing relates to the student's need to move from pen and paper strategies e.g. drafting all work by hand in the first instance, to using the virtual or digital equivalents which are faster and play to his existing strengths.

It is hoped to demonstrate that the more appropriate context for incorporating AT-based strategies into a student's battery of learning tools is within the setting of a

one to one specialist support session. This is set against the historical approach of there being separate 'AT training' for students with Dyslexia being funded under the DSA scheme.

Student A was a first year undergraduate student who was awarded Specialist Support under the DSA scheme as well as separate AT Training. This was on the basis of his SpLD, in this case, dyslexia.

### **Definition of SpLD/Dyslexia**

I feel it is important to begin by defining dyslexia which is the SpLD pertinent to the case study. This should serve to specify the exact nature of this investigation and literature review. One must always bear in mind that reading is a learned activity and is part of our cultural rather than our biological evolution – there are neither specific genes nor biological structures specific to this task. Therefore, dyslexia cannot be a flaw in the brain's reading system as there is no specific reading system (this remains a common misunderstanding i.e. it is seen as a reading disability). A child has to learn that orthography (the sequence of letters on the page) represents the phonology. Wolf (2008) states that all 'human behaviours are based on multiple cognitive processes, which are based on the rapid integration of information from very specific neurological structures, which rely on billions of possible connections, which are programmed in large part by genes....reading has no direct genetic program passing it on to future generations'.

It is only when one understands and appreciates the complexity of the act of reading that one can arrive at a more inclusive definition of dyslexia. There is a pyramid of reading behaviours, beginning at the most basic level, which is the genetic foundation, above this there are the neurons and circuits, subsequently the neural structures, the perceptual motor conceptual processes (where the bulk of current academic research focuses) and finally the behavioural level (reading). The penultimate level, which consists of basic perceptual, conceptual, linguistic attentional and motor processes, is where most theorists believe the difficulties underlying dyslexia can be found. However, it is important to remember that 'dyslexia has an organic neurological basis and, contrary to previous strongly held beliefs, it is not 'purely psychological' (Stein, 2006).

The definition most pertinent to this student is as follows: 'Dyslexia is not one thing but many – to the extent that it may be a conceptual clearing house for a variety of difficulties with a variety of causes' (Rice and Brooks, 2004).

A further factor in dyslexia (and is a factor in the student participant in this case study) relates to working memory. There exists a cycle of disadvantage for students with dyslexia, in our educational context, in that one of the likely sources of poor memory performance is their already established difficulties in phonological processing (Dockrell and McShane, 1993). Given that the working memory system includes a specialised phonological store in which verbal information is retained, children with dyslexia are highly likely to have problems learning to read from their earliest days in education.

According to Shaywitz (1996), the phonological model of dyslexia defines dyslexia in terms of difficulties 'associated with converting phonemes (smallest meaningful segments of language) into symbols (letters). The mental activity associated with reading can be divided into word identification, phonological processing and cognitive reasoning. A deficit in phonological processing will reduce a person's ability to convert symbols into sounds (reading) and/or sounds into symbols (writing)'. 'When phonological awareness and central executive function are examined with respect to their role in literacy, it does appear that working memory accounts for unique variance in reading performance' (Pickering, 2004). Pickering goes on to argue that some caution is required when looking for a definitive explanation for all literacy difficulties and that it should be borne in mind that a range of cognitive processes are important in the task of learning to read. Against this background, Pickering (2006: 238) listed the following in her summary:

'Children with poor working memory skills typically make poor academic progress in the areas of literacy and mathematics.

Children with working memory impairments frequently fail in classroom activities that impose significant working memory loads.

The most common type of classroom failure involved forgetting instructions, losing place in complex tasks, and struggling in tasks that involved both processing and storage loads'.

A secondary factor is the concomitant effect on self-esteem. Research shows that 'dyslexic children tend to suffer from low self-esteem. Therefore, it seems likely that

programmes will be more successful if, alongside practical support, they emphasise activities and tasks that allow dyslexic learners to recognise not only their weaknesses but also their strengths and areas of competence' (Eliot, Davidson, Lewin, 2007). The repercussions of rejection in early learning echo throughout one's life, i.e. it erodes self-esteem which, in itself, is an indication of low self-efficacy. The SpLD Working Party Report on Dyslexia (2005: 6) notes that: 'Low self-esteem, often due to past humiliations, is especially apparent in mature students'.

### **The Role of the Specialist Support Tutor**

In the context of providing a student with SpLD with specialist support it is incumbent on the tutor to realise that 'all difficulties encountered by a learner during his education and training, whatever the causes, need to be addressed' (Backhouse and Morris, 2009: p.16/17). The role of the Specialist Support Tutor is to allow students to build on their self-confidence and self-esteem and to introduce forms of support to help students bridge the gap between their current abilities and intended goals while taking into account their phonological and working memory and other issues that may be related to the wide range of specific learning difficulties.

According to Bandura (1995: 2): 'Self-efficacy is the belief in one's capabilities to organise and execute the courses of action required to manage prospective situations'. There are four major sources for influencing personal competence (Bandura, 1977). First, self-efficacy beliefs can be enhanced through personal accomplishment or mastery as far as success is attributed internally and can be repeated. A second source is vicarious experience. When a 'model person' who is similar to the individual successfully masters a difficult situation, social comparison processes can enhance self-efficacy beliefs. Third, there is symbolic experience through verbal persuasion by others (e.g. a teacher reassures a student). The last source is emotional arousal, that is, the person experiences anxiety in a threatening situation and thus feels incapable of mastering the situation. In terms of feeling, a low sense of self-efficacy is associated with depression and anxiety. Persons with low self-efficacy also have low self-esteem and they harbour pessimistic thoughts about their accomplishments and personal development.

Dale H. Schunk is an educational psychologist who took Bandura's theory of self-efficacy into the realm of education, cognition and learning. According to Schunk, (2003: 160): 'Personal and environmental factors affect one another. As an example

of how beliefs can affect the environment, consider students with high and low self-efficacy for learning. Those with high efficacy may view the task as a challenge and work diligently to master it, thereby creating a productive classroom environment. Those with low efficacy may attempt to avoid the task, which can disrupt the classroom'.

Maintaining attention to the task at hand is a cognitive function that often seems indistinguishable from working memory. 'There is an exceptionally strong relationship between working memory and attention' (Dehn 2008: 84). In order to ensure that the tutor circumvents this difficulty, a variety of teaching strategies should be used such as modelling, feedback, questioning, and cognitive structuring. These are applications of Vygotsky's Zone of Proximal Development. These strategies scaffold student learning from assistance by others to self-learning. The goal is for internalisation to take place. Vygotsky (1978: 86) defined the Zone of Proximal Development as 'the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers'.

Larkin (2001) researched teachers who 'scaffolded' instruction (those who incorporated several of the eight essential elements of scaffolding into instruction) and this was seen to have positive results.

This was the approach I adopted in that the overall goal as outlined by Mortimore (2008: 113) was that the 'external scaffold modelled by the teacher must be internalised by the students'. In this case-study, the emphasis was on learning by doing and given that the strategies were IT-based, the student had to have access to his own computer which he could bring to the support sessions and/or there had to be access to two computers in the support venue. Metacognition skills have to be taught in context if the student is to internalise the scaffolding strategies.

Metacognition as defined by Flavell (1976, p. 232), who first coined the phrase, 'refers to one's knowledge concerning one's own cognitive processes or anything related to them, e.g., the learning-relevant properties of information or data'.

In the context of this case study, the reframing would entail Student A becoming more proficient in using IT-based strategies rather than his existing analogue way of working (using pen and paper).

## **Student A: educational background and diagnostic assessment**

Student A was aware of some longstanding issues with some aspects of his academic performance, in particular, with respect to languages and his examination performance. However, an underlying reason was not suspected until he was at Sixth Form College. A screening indicated that he had a high number of what were termed dyslexia-type characteristics. He notes that he did not follow this up given the connotations of being what he felt was 'special needs' i.e. the label was not one he wanted associated with himself.

He was diagnosed prior to commencing his undergraduate degree programme (BA Anthropology and Management). He received DSA support in the form of technological assistance (notebook computer, printer, scanner, MS Office, Claroread Plus, Inspiration, recording device) and a recommendation that he attend what was previously termed study skills (30 sessions) and IT Training (6 half days). He received all the hardware and software awarded but he did not take advantage of any specialist tuition or IT Training as he noted that there was 'too many things to organise'.

Student A is currently re-sitting his first year and the feedback from his tutors (with which he concurred) related to a perceived 'lack of research'; problems writing in an academic style; but most importantly of all, the fact that there was a lot of coursework not submitted. Of the coursework that was submitted his average grade was 65%.

His diagnostic assessment notes that he is 'of high intellectual ability with particularly outstanding verbal reasoning skills. His profile highlights weaknesses in phonological processing, visual processing (visual short term memory) and auditory/working memory. His auditory/working memory is his weakest score – and his phonological memory score is significantly lower than his digit span auditory/working memory score.

His diagnostic assessment can be equated with the assessment of need using the five headings which form the overarching structure of the IT Strategies being recommended. These five headings can be seen as schema which Mortimore (2008:101) defines as 'a general representation of the typical structure of a familiar experience'.

	Diagnostic Assessment	Assessment of Need
Research	'Student A's score of 119 reflects excellent ability in silent reading comprehension and his reading speed, at 207wpm, is approximately 20% below the average adult academic reading speed of approximately 250wpm'.	Current Strategy: Student A tends to skim read and writes notes on sheets of A4 - references and quotes. He does not always trust his own notes and prefers to purchase texts and/or photocopy material for highlighting and annotation.
Composition	<p>In the free writing test, Student A was asked to write for ten minutes and wrote in a sprawling part-cursive form with very low legibility and a large percentage (over 20%) of undecipherable words and in some cases he was not able to read them himself.</p> <p>Student A's spelling score of 93 is within the average range it is below the level indicated by his profile. His errors reflect specific difficulty with the spelling of longer words. A significant weakness with using homophones was also reflected.</p>	<p>His research informs his composition in that he lies all of the research notes on the floor and rearranges these into a structure – almost like 'creating a jig-saw'. That forms the skeleton of his essay. He works in a visual way –likes to see all the research notes at once – he does not file things away.</p> <p>Compiles in chunks – so can take any section of his 'jig-saw' and write this – does not begin at the beginning and work his way through – introduction is last and he commences with ending.</p> <p>He is able to touch type and his speed is far in excess of his handwriting speed.</p>
Proofreading	Student A has a weakness in the speed of phonological processing (rapid naming, CTOPP). This is the retrieval of phonological information from long term memory – word finding. (see related spelling issues under Composition)	<p>Student A had informal assistance from a 'housemate' who checked all his work for him – this person is no longer available to assist him.</p> <p>Rarely has time to proofread – tends to do this on-screen as he compiles his work while word processing.</p>
Note-taking	Student A wrote in a messy and generally undecipherable script. Student A's copying speed is notably below average at 27.5wpm and indicates that he is likely to require support to successfully manage copying	He is taking notes in lectures but has to work really hard at concentrating and maintaining his focus – in first year he was just listening and consequently had very few notes to which he could refer.

	tasks.	
Time Management	Student reports issues relating to punctuality and planning his revision and coursework.	He sees this as a major area of difficulty in that he cannot create effective time-tables for study and finds it difficult to estimate how long academic tasks will take

In this case, I was the DSA assessor concerned and what was immediately obvious to me while assessing his preferred IT strategies was that when he typed information into the spider diagram that had been created in Inspiration, his speed was extremely fast. When asked about this he confirmed that he was an avid user of 'facebook' and MSN Messenger and was in almost constant communication with people via his phone which had a QWERTY keyboard layout. Consequently, he demonstrated that with sustained use he had become a proficient typist and was, in effect, touch typing, although he had not undergone any formal training. This was evidence that he was able to hone a skill to a professional level and as such, he should take some solace in this when reviewing his learning strengths and abilities. Interest in a topic or an activity overruled any issues with self-esteem and his initial reaction to using enabling software. However, at the time of his assessment of need, the majority of his strategies were pen and paper based. A computer was perceived as a means of communication and occasional research.

In the case of the student's learning style, a previous screening he had undertaken noted that he was a visual learner. While this should not be taken as absolute, a number of his existing strategies included using colour and highlighting.

### **Introducing Student A to an IT-based programme of specialist support in the context of DSA provision**

DSAs are grants designed to meet the 'extra' costs or expenses that students face as a direct result of a disability or SpLD for example dyslexia. All full-time, part-time and postgraduate students qualify for assistance as these grants are not means-tested. DSAs consists of three components, each with its own specified maximum amount of financial assistance as follows: an equipment allowance, a non-medical helpers allowance, and a general allowance. In the case of students with SpLD,

eligibility requires a diagnostic assessment compiled in accordance with the SpLD Working Group 2005/DfES Guidelines.

Traditionally, the Disabled Students Allowances scheme awards students technological assistance with concomitant IT Training and specialist support (formerly known as 'Study Skills'). These components were often compartmentalised in that the supplier of the equipment, the IT Training, and the specialist support could be all different suppliers with very little communication or interaction between all three. In theory, the responsibility for unifying the support being provided belongs to the DSA assessor concerned but the nature of the sector is that each service evolved separately and in almost total isolation from each other. The current DSA Assessment of Need methodology approved for use by the Student Loan Company uses a schema of five headings to represent the various academic tasks that students with SpLD have to undertake i.e. it represents the context within which students find themselves rather than using a more medical model approach whereby the report listed areas of difficulty the student experienced solely. It is referred to as the strategy approach in that it requires DSA assessors to use the diagnostic assessment as the basis of his/her recommendations and to complement this with the assessor's observations on how the student has learned to adapt previously in the academic environment. All previous strategies would be used to inform the suitability of using the array of multi-sensory hardware and software solutions available at a typical assessment centre.

The aim of this strategy approach was to consolidate the link between an assessors' recommendations and downstream services (IT Training, Specialist Support provision etc.). Subsequent feedback from these services would ensure a better and more holistic service to the student concerned. The long-term aim is to receive formal feedback from trainers and specialist tutors on the efficacy of the strategies being recommended by assessors. The concomitant programme of IT-based strategies was initially created to ensure that students with SpLD received training more pertinent to their need rather than generic features-based training. This programme of IT-based strategies was informed by student guides such as Hargreaves (2007). A copy is at [Appendix I](#).

## **Programme A**

This was implemented after Student A had received DSA and following first year exams (before results). The aim was to provide him with a basic understanding of the strategies recommended in his assessment of need report and the concomitant software. I adapted the eight-step list compiled by Nist and Mealey (1991) and incorporated this into my teaching of IT-based strategies as follows:

- (i) focus the attention of the student;
- (ii) provide the student with a general overview of the strategy and the context within which it would be used;
- (iii) play a screen-capture video of the strategy and repeat by demonstrating the strategy on the computer;
- (iv) guide the practice – student repeats the strategy but is able to ask assistance;
- (v) independent practice – student undertakes strategy without recourse to asking for assistance or replaying the screen-capture video.

The basis of the training was ‘learn by doing’ utilising his existing excellent keyboard skills. Student A had previously used a computer only for social purposes, or ‘typing up’ coursework, not for research or document drafting. Notes and drafting were entirely paper-based using coloured spider diagrams.

Each 2 hour session related to one of the five headings of the assessment of need schema with the only variation being we started with ‘Time Management’ rather than ‘Research’.

Although Student A responded positively to each session but it subsequently emerged that the majority of the strategies were not incorporated into his existing battery (although he began using ‘Google’ for spelling checking and defining words; using text to speech to have web-sites read aloud, and he began adding terminology and course-related words to the lexicon of MS Word).

## **Programme B**

This programme was undertaken in the first term of his repeat year. One of the interesting facets of this case was that the student had never obtained an overview of the course requirements and all work on my project ceased for the first session as it was necessary to ensure that he was completely *au fait* with what his degree programme required him to undertake. However, it was not completely abandoned

as we created a timetable for him in MS Outlook and listed all coursework deadlines in his MS Outlook calendar.

The remaining sessions focused on using a programme of strategies identical to the list used in Programme A but with the only difference being that the overarching theme became his immediate point of need – the most current piece of coursework. Thus, strategies were taken from a variety of the headings used in the assessment of need schema depending on Student A's point of need. In this context, the strategies began to have a more dramatic effect in that their effectiveness in terms of speed was more evident in a 'real' context. He notes that he began to realise how much faster it was for him to draft in MS Word, produce spider diagrams in Inspiration (which could be hyperlinked to relevant research documents); how he could collect quotes and collate references using the Web and MS Word and/or Claro Capture; how all of the strategies taught were simply virtual equivalents of his previous learning strategies. The main paradigm shift for student A came when we began to calculate how much less time was being spent on tasks such as researching and composition and how all of the enabling programs were to be used in conjunction with each other rather than in isolation e.g. scanning material into MS Word using ClaroRead Plus, having it read aloud, using active research techniques when reading it himself, highlighting the key points in MS Word, and copying these into research mind maps in Inspiration.

All of this was confirmed by the fact that Student A became far more adept at using the AT-based strategies in the context of programme B and re-framing occurred in that he continued to use these strategies. When undertaking his second assignment they have become integrated into his way of working. His virtual strategies became part of an overall virtual version of producing any piece of coursework e.g. a virtual desktop with virtual folders containing: documents, mind maps, lecture recordings (sound files), all hyperlinked together in an order that mirrors the structure provided by his course on a timeline mirroring his course timetable.

## **Conclusion**

One of the more salient points to emerge from the literature review undertaken as part of this case study was highlighted by Mortimore (2008:113): 'the most effective programmes seem to be those that involve two approaches: (i) they are firmly grounded within the real tasks that need to be accomplished; and (ii) they follow the

social-learning apprenticeship model...sometimes termed the scaffolding, modelling or apprenticeship approach'.

My experience of working with a student in two different contexts informed by background research and a review of literature, observation, Interview, led me to concur with this finding. Meeting the point of need produces a more appropriate context for imparting knowledge that is internalised and integrated into the student's approach to learning.

If the basis of all DSA technological recommendations for students with SpLD is a schema of AT based study skills strategies then the context in which they are delivered should ideally mirror that of a Specialist Support Tutor in terms of teaching practice. Specialist Support Tutors should work towards being able to provide this service if we are to deliver best value for money for both the student recipient and the taxpayer. All study skills based AT strategies are, in effect, recommendations for the Specialist Support Tutor. The corollary being that all AT providers for students with SpLD under the DSA scheme should be cognizant of and have some experience of teaching practice.

## **APPENDIX I**

A selection of the related screen capture videos can be seen at:

[www.aspire.uk.net](http://www.aspire.uk.net)

### **Research Strategies**

- Creating research sub-folders for his assignments;
- Scanning the document into MS Word (or downloading from the Internet);
- Having text read aloud – paragraph at a time;
- Having PDF files read aloud;
- Ensuring student is aware of need to then read the relevant paragraph and highlight the key words or themes;
- Using Full Screen reading and MS Word Research;
- Cutting and pasting key words into corresponding mind maps.
- Researching on-line e.g. using Google scholar.

### **Composition Strategies**

- Making mind maps of research mind maps.

- Using keyboard shortcuts and switching between applications;
- Creating assignment folders, sub-folders and hyperlinks between folders;
- Improving the appearance of work in MS Word (inserting tables, images, mind maps)
- Creating hyperlinks to MS Word documents and Web-sites;
- Understanding the assignment brief and structuring the assignment;
- Planning and narrating presentations.

### **Proofreading Strategies**

- Expanding the lexicon of MS Word;
- Spellchecking, autocorrect and the thesaurus in MS Word;
- A range of on-line dictionaries is available at:
- <http://www.yourdictionary.com/diction4.html>
- <http://www.dictionary.com/>
- Using Google as a spellchecker or to define any word by typing 'define:' followed by the word in question in the search box and pressing return;
- Using text to speech;
- Using homophone detection;
- Ensuring that the background colours being used by *MS Windows* are appropriate and a brief demonstration should be included in his training.

### **Note-taking Strategies**

- Using the Cornell and Mapping method;
- Enhancing downloaded lecture notes – using comments, highlighting, annotating text in MS Word.
- Using track changes to match his outline notes;
- recording lectures;
- taking outline notes using the mind mapping technique during the lecture;
- embellishing his outline notes subsequently with more details from the recordings;
- transferring lecture sound files to his computer.

### **Time Management Strategies**

- Using MS Outlook;

- Identifying strengths and weaknesses in time management practices
- Making a list in MS Outlook of what has to be accomplished during the coming week, including class assignments and class attendance;
- Estimating how long each task will take;
- Identifying the day on which each task will be accomplished, keeping in mind the amount of time the task will take and other things you must also do that day;
- Writing out a weekly schedule at the beginning of each day and prioritising tasks;
- Evaluating the daily schedule at the end of each day.
- Managing and prioritising time within the context of coursework submission deadlines.
- (Calendar and Tasks).

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DSA LA Guidance Notes can be downloaded from the SFE web-site:

[http://www.practitioners.slc.co.uk/media/287438/disabled\\_students\\_allowances\\_12-13\\_final.pdf](http://www.practitioners.slc.co.uk/media/287438/disabled_students_allowances_12-13_final.pdf)

SFE Guidance on assessments of need and template assessment of need reports compiled by the author are available to download from the SFE web-site:

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# “Unusual Talent: a Study of Successful Leadership and Delegation in Entrepreneurs who have Dyslexia”

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## Abstract

This study seeks to understand how successful entrepreneurs with dyslexia lead and manage their ventures and deal with workplace communications.

Informed understanding of dyslexia potentially benefits organisations and helps employees to reach their potential. This research breaks new ground by providing evidence that positive aspects of dyslexia, when harnessed can benefit individuals and organisations.

Two questions are examined, firstly, what explains the high proportion of people with dyslexia among successful entrepreneurs, and secondly, what skills or attributes have given these individuals a head start?

Literature about dyslexia in adults in the context of the work place is examined alongside relevant entrepreneurship literature on leadership, team building and delegation.

A simple methodology has been utilised, a convenience sample of successful entrepreneurs with dyslexia were interviewed about their skills and how they run their ventures. These interviews were taped, videoed and transcribed. They were coded and analysed for common themes.

The study found that successful entrepreneurs who are also dyslexic have good oral communication skills they can communicate ideas clearly; they have good people skills; enthusiasm When they are in the process of starting the business they are able to network with others, explain their business vision and generate enthusiasm for their new venture. They are also often good sales people because they have an interest in others. In short the dyslexic potential entrepreneur may have skills that are very advantages for getting started in business. The ability to delegate is an essential task if the business is to grow and we see this skill in many dyslexic

entrepreneurs. This is because dyslexics often learn early in life to trust those around them to do the things they are not so good at.

Many of the respondents in this study found working in the corporate environment frustrating so running their own venture was a viable alternative career move.

Practitioners working in further and higher education are uniquely placed to offer advice about career choices and will therefore find this study useful, as will students who have dyslexia.

### **Adults with dyslexia at work.**

The limited research available on adults with dyslexia and their employment tends to focus on the difficulties they experience. Existing studies evidence stress at work associated with dyslexia (Hales, 1995; Reid & Kirk, 2001). Bartlett and Moody (2000) describe workplace anxiety, bewilderment, embarrassment, shame, frustration, anger, despondency and depression. McLoughlin et al. (1994) discuss difficulty in holding down jobs. In 1987 ALBSU produced evidence that people with dyslexia earn less than non disabled people (the study has not been replicated more recently). In 2008 a report by the UK Trades Union Congress asserted that managers rarely appreciate links between dyslexia and commonly-related performance issues. As a result they may discriminate unwittingly and in some cases this has resulted in dismissal of individuals. A number of these cases have ended up at industrial tribunals (TUC, 2008).

Fitzgibbon and O'Conner (2002) suggest large organizations can be dyslexia unfriendly because of environmental factors which are difficult to control. Taylor and Walter (2003) found adults with dyslexia were much less likely to follow professions such as finance, management, science, and computing and more likely to choose people-oriented occupations such as nursing or sales.

The authors suggest that a degree of environmental control allows the affected worker to be more creative and more involved with people. Successful people with dyslexia also develop ways of exerting control as a mechanism for coping with and compensating for difficulties (Fitzgibbon & O'Connor, 2002). Logan (2001) discovered that the incidence of dyslexia among entrepreneurs in the UK is 19%. Subsequent research in the USA found the proportion to be more than 30% (Logan, 2009). That is double and treble, respectively, the rate found in the general adult population (BDA, 2009). Logan (2009) discovered that only 3% of corporate

managers in the UK are dyslexic and a mere 1% in the US. She proposes that because individuals with dyslexia feel more comfortable managing when they feel they have more control over their situation this may well lead to a preference for starting new ventures.

Among others also adopting a positive view, Stein (2001) suggests:

‘The genes that underlie magnocellular weakness would not be so common unless there were compensating advantages to dyslexia. In developmental dyslexics there may be heightened development of parvocellular systems that underlie their holistic, artistic, ‘seeing the whole picture’ and entrepreneurial talents.’

Evidence that dyslexia is associated with enhanced right-hemisphere skills is cited by Geschwind, 1982; Galaburda, 1993; West, 1992; West, 1997; Reid & Kirk, 2001 and others. Use of intuition, visual thinking, spatial intelligence, pattern recognition, problem solving and connected forms of creativity are associated with the right hemisphere. Reid and Kirk (2001) believe that these skills are critical in many business activities including recruitment, decision-making and innovation. Moody (1999) asserts that holistic processing associated with dyslexia can lead to creativity and innovative approaches.

Evidence is cited by Everatt, Steffert & Smythe, 1999 of development of compensatory strategies translating into transferable skills which can provide an edge in business. Nicholson and Fawcett (1999) suggest that enhanced communication skills may compensate for poorer literacy.

Entrepreneurs with dyslexia were found by Logan (2009) to be more likely to score themselves highly on communication skills than would non-dyslexics (using a five point likert scale: ranging from one, poor, to five, very good).

Delegation was deployed more by entrepreneurs with dyslexia than by those without (who found the skill of delegation hard to master) (Logan 2009). Logan also found that entrepreneurs with dyslexia tend to grow their companies more quickly (a finding statistically significant at the 90% confidence level). She proposed that this is in part a consequence of their ability to delegate (Logan, 2009).

In summary, it seems the corporate workplace is often stressful for those with dyslexia. Arguably many stressors are socially constructed by an unsympathetic work environment. Therefore they tend to gravitate towards careers as entrepreneurs or in people-oriented occupations in contexts where greater autonomy

and control is possible. Heightened interpersonal skills, often displayed by workers with dyslexia, can be very useful to employers.

An examination follows of entrepreneurship literature concerned with leadership, team building and delegation.

### **Leadership, team building and delegation**

Research on leadership and management of the human resource function is evident in general management literature but less is available within the context of small entrepreneurial companies ([Katz et al., 2000](#)). Entrepreneurship literature is unequivocal in its contention that if a new venture is to grow the entrepreneur must have leadership qualities (Perren, 2000; Perren & Grant, 2001; Perren & Burgoyne, 2002). However, Freel finds that many entrepreneurs lack leadership skills (Freel, 1999). Nicholson (1998) suggests that whilst some have prior experience in large organizations, many entrepreneurs reject this career pathway. Consequently this limits opportunities to learn leadership, empowerment and management skills in formally-structured organizations (Kempster and Cope 2010). Entrepreneurs, unlike many managers, will probably not have undergone a leadership apprenticeship (Kempster, 2006). Corporate managers however often receive pre-promotion leadership training and opportunities to observe leaders. This affords the chance to consider and possibly emulate leadership behaviours to facilitate dynamic teams. Most entrepreneurs will, in contrast, have had to learn either by trial and error (Gibb, 1997; Cope, 2005a), by gathering information from their social networks (Hoang & Antonic, 2003), by observing leadership within the family (Kempster & Cope, 2010) or by actively seeking training (Mazzoral, 2003).

Kempster and Cope (2010) found most entrepreneurs in their study saw their role as facilitator of business success, rather than leader, reflecting restricted understanding of the leadership role. Often the result was that the venture was hampered or grew more slowly than was likely if the entrepreneur had implemented a conscious leadership strategy.

A gap was identified by Mazzoral (2003) between the owner-manager's vision and confidence in where the venture is heading, and their ability to articulate this to employees.

‘As the business grows and the number of employees increases, the owner-manager is challenged by the need to articulate their company's vision and mission so as to achieve a unification of purpose within the organization.’

In summary, apparently, many entrepreneurs must develop leadership skills whilst running the company. This ‘learning through doing’ may slow growth as it will take the entrepreneur time to explore different methods and to develop a style which facilitates team development and empowerment.

At the start of every new venture the entrepreneur will have to be able to complete all the tasks involved in running a business. Success and expansion eventually requires the entrepreneur to recruit, train and empower a team and to learn to delegate effectively (Smith, 1992; Formichelli, 1997; Timmons, 1999). Without an effective team the entrepreneur is unavailable to explore and develop new opportunities (Rosa 1998). Delegation is difficult for many entrepreneurs and this is a barrier to small firm growth (Churchill & Lewis, 1983; Greiner, 1972; Story, 1994; Perren & Grant, 2001). Baker (1994) explains that whilst there is a need for the entrepreneur to empower their team by delegating, many struggle to hand over authority, therefore teams are not empowered. He also suggests many entrepreneurs find it difficult to embrace the coaching role as a mechanism for team development and business growth.

Reluctance to delegate key tasks may arise from anxiety about the consequences of handing over control, even fear for the survival of the firm (Matley, 1999).

Entrepreneurs faced with limited resources with which to recruit good people are even more reluctant to delegate (Hornsby & Kuratko, 1990; Atkinson & Storey, 1994). Mazzarol (2003) suggests that conditions for successful growth include learning to delegate authority and responsibility and developing structures, policies and practices to enable employees to embrace responsibility and participate in dynamic teams. He found that entrepreneurs moved from micro-management to empowerment and delegation as a result of training and as a response to environmental pressures. Mazzarol reports:

‘Faced with growing markets and increasing production the owners found themselves unable to achieve their goals using the haphazard HR practices with which they first operated their businesses.’

The European Commission (2006) found that entrepreneurs are reluctant to spend their limited resources on training for themselves; therefore delegation skills may be

learned by trial and error. The entrepreneur is clearly disadvantaged by having to learn to lead and delegate as they go. This is risky, will take time, and may hamper or slow growth. People with dyslexia often start their careers at a disadvantage yet many become successful entrepreneurs. The research presented here considers whether entrepreneurs with dyslexia have different experiences from non-dyslexics, whether aspects of dyslexia could be beneficial in entrepreneurial situations and advantageous in business.

## **Methodology**

Two female and eight male entrepreneurial business leaders, all formally diagnosed with dyslexia, agreed to be interviewed and filmed for this case study research. They were part of a group of 19 volunteer mentors from a scheme to mentor younger people with dyslexia which was initiated in March 2009 by the British Dyslexia Association (BDA). (<http://www.bdadyslexia.org.uk/get-involved-and-fundraising/mentoring.html>).

The entrepreneurs came from careers in retail, service industries, television, consultancy, information technology, and engineering. Seven could be described both as entrepreneurs and business leaders because their businesses have multi-million pound turnovers. Three led successful and sustainable social enterprises. The participants were self-selecting and a convenience sample. Though not a statistically significant sample, the ten interviewees provide us with a greater understanding of the potential of those with dyslexia.

Ten case studies were developed through semi-structured interviews using a common template. Interviews were conducted by an experienced interviewer with no specialized knowledge of dyslexia (which arguably added to his objectivity). Interviews were videoed, transcribed and subsequently approved for release by interviewees.

All transcripts were subjected to content analysis; responses were coded and grouped under emerging themes which highlighted the issues of greatest importance to participants. Subsequently further analysis was undertaken to identify patterns, including any significant differences between the opinions, beliefs and values of the interviewees.

## **Question design**

Questions covered schooling, early and current career, and business 'style'. The interview approach ensured that participants were free to tell their story within set parameters. Four questions about early life experience aimed to provide insights into their possible influence on later decisions, behaviours or actions.

1. When did you discover you were dyslexic?
2. How did having dyslexia affect your school days?
3. Is there a family history of dyslexia?
4. How would you say dyslexia has affected your confidence?

Four questions about business life and the affect dyslexia may have had on the individual within the work environment were designed to explore positive and negative impacts.

5. How has your business career evolved?
6. In what ways has being dyslexic affected your business career?
7. Which do you find is the most effective way of communicating your message?
8. How has being dyslexic affected the way you work with other people (customers, partners, and staff)?

## **The findings**

### **Background Information**

Seven participants had been identified with dyslexia at school or university. Three found out when their own children were labelled. Nine described feeling 'stupid' (their word) and severely lacking confidence whilst in education and in their early career. Business success brought greatly increased confidence, particularly when dealing with their area of specialization. However all respondents said they continued to worry about, and tried to guard against being tripped up by concerns they associated with dyslexia.

Interviewees typically relied on technology and a wife/partner/friend or non-dyslexic business associate who was willing to write for them and do much of the detailed work essential for running a business. Technological solutions included: Smart phones, Spell checkers and Dictaphones and assistive technologies such as speech recognition software.

Most had practical, vocational or menial jobs before starting their business. Half had been employed by a large company but had decided to leave.

- 'I was at the BBC for quite a long time but I always wanted to better myself. I suddenly realized that I wasn't going to go up the ladder at the BBC because the whole culture had changed... It reminded me that the inability to read and write was going to limit me in that sort of organisation. I'm driven to succeed so I decided to leave.' WE
- 'I ended up at Oxford University in the computer laboratory doing research as a social scientist, as an ethnographer, which was fascinating. But I did find after a number of years that the inability to write and the dyslexia became such a frustration for me that I felt I had to leave academia.' MB
- 'And when I got into the work environment I discovered my dyslexia became a problem again because the job I got involved me writing reports. So unfortunately my different way of working - which doesn't involve writing great long reports in three minutes that are eloquent ... it takes me a great deal more time – again came back to haunt me.' AC

Data analysis revealed four emerging themes. People with dyslexia who do well in the workplace have learned to be very good at communicating their vision, delegating, leading and team-building, and harnessing their ability to think differently.

### **A. Leadership style**

In response to the question 'How has being dyslexic affected the way you work with other people (customers, partners, and staff)?' the entrepreneurs described using a (people-centric) team approach (with the focus on personal relations) in order to grow their business.

- 'I like to think that the way I work with people is an involving way. I love working in teams. It's always a joke in our family with my wife that I can't do anything on my own. I can't change a light bulb; I've got to have somebody helping me. But I do like the involvement of people around me, as stimuli, for ideas, and people who drive things forward. And, of course, you can't do anything on your own in life.' DR

- ‘I love dealing with people. Don’t judge people by what you see on the surface. I’m fascinated to know what’s underneath the protection that enables people to survive life. And if you can get to what’s underneath it means they can operate much more effectively.’ WE
- ‘I built up a great team of people around me. One of the major strengths if I look back was my ability to pick great people, to work with them and to create a wonderful environment where everyone wanted to succeed together.’ DR
- ‘I’ve always engendered great loyalty in my employees because I listen to them. I understand what they want to get out of life. I help them understand themselves. And through that we work together on every project. And that’s a very powerful way of leadership in an entrepreneurial environment.’ MB

## **B. Communicating the vision**

When asked ‘Which do you find is the most effective way of communicating your message?’ the entrepreneurs talked about the way they (verbally) ‘painted pictures with words’ in order to express themselves.

- ‘In terms of wanting to get people behind you to deliver a business, then that’s about communication, that’s about meetings, that’s about standing up and inspiring people, that’s about telling stories, that’s about painting pictures with words that people can follow so that they want to do whatever it is that needs to be done. Or they can say: ‘I can see completely the picture you’ve just painted with all those words, but it’s dreadful and it’s never going to work because ...’ ZA
- ‘My best form of communication is verbally. I learned to colour pictures very vividly ... the pictures I was feeling.’ JS
- ‘Being able to convey a story, or the importance of why something has to happen ..., face to face is the best for me.’ GQ
- ‘I’ve discovered that my particular skill is visual. My hobbies include photography. I communicate very well visually. I enjoy it and feel at ease and can draw out performances.’ WE

- ‘I obviously work very well in a verbal environment, an oral environment, where I can present to people, talk to people, meet people face to face.’ DR
- ‘I like to talk to people. I like to engage people. I like to win their confidence. Often leading by example, but winning the team over is important to me. Winning the confidence of people is important. And I can best do that by talking to them and, as I say, showing by example rather than producing something in the written form.’ JH
- ‘Largely, my business abilities stem from those challenges [as a dyslexic schoolboy]. If I want today to go and sell or market something or introduce a new concept to the board of a major multi-national corporation, those skills are still my basic skills – of communication and of getting people on board by being excited by the descriptions of what the upsides or the downsides might be. I genuinely believe they may be as dumb as I am. So if I give them as colourful a picture as I can of what potential there may be in something there’s a much better chance of me being able to sell the concept.’ JS

### **C. Delegation**

Ability to delegate (and the necessity to do so in order to facilitate success and the growth of their companies) is one of the strongest themes voiced by the participants.

- ‘Even back in the early days at school I was always looking for ways to get somebody else to do the writing bit as I could do something else. It’s always like ‘there’s going to be a trade here’: I need this other person at school to write my report for me, so what can I do?’ MB
- ‘Over the years you just learn to play to those skills and strengths and complement them by people around you who perhaps make up for your short-comings. So identify what your short-comings are then make sure that people around you, the team around you, are there to help and support’. DR
- ‘I’m able to delegate because that’s what I’ve done all my life. If I’ve got a large document that needs proofing I’m able to say, can you proof

that for me? If I didn't announce that I am a dyslexic person I think things would be a lot more difficult.' MA

- 'If you want to expand and grow organizations you have to be able to delegate, to be able to trust other people around you and find ways of pushing things forward. I love working in teams. That's my passion if you like.' DR
- 'I've surrounded myself with people who are considerably better at what they do than I believe I am at what I do. So my reliance on other people is very high.' JS
- 'When I got to running my own company, delegation is considered to be one of the most important attributes of a successful business-person. I naturally delegate; I have to delegate. There's no way I can get through the day without delegating on a daily basis. I was very natural at it and that, I'm quite convinced, is one of the reasons we were able to grow our company so rapidly without it just exploding in on itself. MB
- 'I am conscious of when I need to delegate and how I can communicate that delegation and why'. AC
- 'The way I look at it it's like a blind man and a deaf man. If you're blind your hearing gets better; if you are deaf your eyesight gets better. If you are dyslexic you build on other skills. And for me they are all about the personal interaction with the individual and using those skills as opposed to the written word. I've also learned to delegate quite well to people who can write better than I can'. RT
- 'What's typical with many entrepreneur types is they end up trying to do everything themselves. So they put in forty hours a day to do everything; then they explode in a pile on the floor. I delegate on a daily basis. I always have to find somebody else to do it and I'm sure that is one of my business strengths.' MB
- 'In the last few years I've twice employed people and paid them more salary than myself because they are the people I wanted in my company to do the job I wanted them to do. And they can do the job a thousand times better than I'll ever do it.' GQ

## D. Harnessing the ability to think differently

In response to the question: How has being dyslexic affected the way you work with other people (customers, partners, and staff)? Entrepreneurs described utilizing intuition and viewed this as particularly important in team selection.

- 'I went along to one of these companies that are supposed to advise you on how to be better at being a managing director or an executive. The chap asked how [When] I evaluate opening a store. And I said, well, I stand outside of it and I can see it. I can see the people. And I can actually work out what I think the money will be. I work it all out in my head. And then I do it. And he looked at me and said 'you need help'. I never went back again. I knew what I did and why I did it and they couldn't understand what I did and why I did it.' GQ
- 'I think dyslexia has allowed me to see very quickly, if I'm talking with some software engineers, about the details of their code. I can see the whole picture of the software. I can see quite clearly what the overall architecture is. I can see the points where their bit fits into the whole thing. I've been told that's very common for dyslexics. And I have certainly used that ability, particularly when I am running large teams of programmers. That is my skill. What I give to the team is that ability to see the whole picture. So that's another thing I think is very, very useful and good.' MB
- 'I'm very quick to try and find the solution. But I'm also very good at the application of that. So if I can see a solution then I can very quickly visualize how it may play out and see what some of those unintended consequences might be.' ZA
- 'I've discovered that my particular skill is visual. I communicate very well visually. I enjoy it and feel at ease and can draw out performances. ... I wish I'd recognized earlier in my life that I am a visual person and I would have directed my whole career towards that.' WE
- 'I just tend to think I see things differently to other people. And, whether it's dyslexia or not, I don't see boundaries, I don't see barriers to doing things. I see ways to do things.' GQ

- 'I'm more somebody that has an instinct, a feeling for what is right. WE
- So I tend to think on my feet. I don't know what the decision is going to be until it's come out of my mouth. I make decisions fast and that is extremely useful in getting businesses off the ground.' ZA
- 'One of the major strengths if I look back was my ability to pick great people, to work with them and to create a wonderful environment where everyone wanted to succeed together.' DR
- 'I back people for their talent. It's much more interesting to me what somebody brings to the table than their skills and abilities, what they've done, what pieces of paper they've got. So I'm quite good at seeing potential and I'm also very good at helping people play to their strengths ... and ensuring that they do. I tend to go with people I like; with people I can get on with.' ZA
- That ability to create things and find solutions to difficult problems, and see them through, and deliver financial business models, has always been a part of me. I think that ability to both do something I enjoy and get a business model behind it is something that's been there for as long as I can remember really. ZA
- I saw the opportunities that were, for me, wide open simply because other people all thought the same way. It's a very narrow road that they travel. JS
- 'For me, being dyslexic means that it's a reason why I see things differently and seeing things differently is exactly what projects in the middle of Palestine needed.' AC
- 'So in many ways the learning disability that I had has turned out to be quite an advantage because the competition isn't that tough when you take a completely different approach to anything that you do.' JS

## **Discussion**

The study yielded many valuable insights into possible reasons why there are so many entrepreneurs with dyslexia. Deficit model thinking is problematised as positive

characteristics useful skills and creative strategies employed successfully in business are illuminated.

Participants typically had someone close willing to undertake work writing and admin tasks. Self employment makes it easier to bring people in to compensate for weaknesses leaving time free to maximize strengths. Despite a decade of equalities legislation ([www.homeoffice.gov.uk/equalities/equality-act/](http://www.homeoffice.gov.uk/equalities/equality-act/)), and the potential for Access to Work funding ([www.accesstowork.co.uk/](http://www.accesstowork.co.uk/)), corporations may be unwilling to hire an assistant alongside a person with dyslexia. Employment within corporations may mean having to work much harder or even take work home in order to complete administrative tasks. Stress and other difficulties are likely to result as discussed earlier in this paper (Hales 1995; Reid and Kirk 2001 and Bartlett and Moody 2000). Starting one's own venture may be preferential to coping with barriers in the corporate environment. Four participants clearly stated that they had left corporate work because of their belief that they could succeed more easily running their own company.

Participants described coping strategies which seem to have given them a head start and corroborated Logan's finding that entrepreneurs with dyslexia tend to grow their ventures more quickly than those without (Logan, 2009).

Content analysis of transcripts revealed four salient attributes: highly developed skills in communication, leadership, delegation and the ability to think differently.

Firstly excellent oral communication skills, possibly developed to compensate for weaknesses in written communication, used to gain an advantage in business.

Participants described having a vision for how their business would succeed and the ability to communicate this persuasively. Most entrepreneurs are passionate about their vision; having excellent communication skills to articulate this passion will almost certainly inspire others. Participants described (verbally) 'painting pictures' to explain concepts, thus facilitating understanding.

Secondly, motivating people to get the job done is achieved by a leadership style which involves developing personal and long-lasting relationships with ones team. Taylor and Walter (2003) discuss excellent interpersonal skills in people with dyslexia. Participants describe how, throughout their lives, they have been able to persuade others and rely on others for help. Responses indicate that participants value the contribution of others, can assess people quickly, keep in touch with the needs of their employees, and strive for better team relationships.

Thirdly, delegation had to be learned early in life and participants had the advantage of being able to bring this well honed skill to their new venture. Because delegation is essential the entrepreneurs tended to value those around them and view building and maintaining effective teams as central to their success. We have seen that delegation is a skill that many entrepreneurs struggle to learn but dyslexic entrepreneurs master this early and gain a head start when it comes to growing a business.

Abilities in communication, leadership and delegation are essential for any successful entrepreneur. Those with dyslexia in the study are notably skilful in these three areas, and display a vital fourth skill – they have harnessed their ability to think differently. They are prepared to trust their intuition when making business decisions, especially when selecting staff. Participants referred to their ability to pick good people and know intuitively that they will fit within the organisation. Participants talked freely about seeing things differently when looking for solutions and about having the ability to paint concepts and solutions in pictures. A propensity to be creative and display ‘right brain’ skills is associated with dyslexia (Geschwind, 1982; Galaburda, 1993; West, 1992; West, 1997; Reid & Kirk, 2001). We observe that entrepreneurs in our study seem to be applying a right brain creative approach successfully to leadership and management.

Research cited here has shown that entrepreneurs may struggle to develop high levels communication, leadership and delegation skills and this can hamper the growth of their businesses. We have found that entrepreneurs with dyslexia tend to acquire these skills early. Amalgamation of communication, leadership and delegation skills with the fourth attribute of thinking differently may well be what gives these entrepreneurs the edge in business. Viewing dyslexia as an aspect of neurodiversity rejects deficit model thinking and celebrates the ability to think outside the box. ([www.brainhe.com/](http://www.brainhe.com/)).

### **Limitations of the study and suggestions for further research**

Findings from this exploratory study derive from a relatively small self-selected sample. Other larger and more quantitative studies suggest an association between dyslexia, entrepreneurship and the ability to grow ventures more quickly (Logan, 2009). The study has contributed to a richer understanding of how successful

entrepreneurs with dyslexia (and often associated right brain thinking) lead, manage and develop their ventures.

Future studies could include more participants and a comparative group of non-dyslexic entrepreneurs. The affects of low confidence on people with dyslexia in business merits investigation. This study found entrepreneurs with dyslexia making use of a proxy to help deal with particular tasks. Another rich area for consideration would be how this might be replicated in the corporate environment.

## **Conclusions**

This research set out to find an explanation for the high proportion of people with dyslexia among successful entrepreneurs and to consider what skills or attributes have apparently given them a head start in business.

Literature suggests that large corporate environments can create organisational problems for employees with dyslexia. Our findings suggest four of the ten entrepreneurs were provoked, as a consequence, to leave the corporate world and start their own ventures.

Participants found that coping strategies developed quite early in life had evolved into skills which helped later, when starting business ventures. Important skill areas included the ability to communicate ideas, lead and motivate, delegate, and harness their intuition. Drawing on earlier finding that entrepreneurs with dyslexia tend to grow their companies more quickly (Logan, 2009), we deduce that possibly these acquired skills enabled them to by-pass the trial and error stage usually required in order to learn to communicate, lead and delegate effectively.

The much higher incidence of dyslexia among entrepreneurs than among corporate managers (six-fold in the UK and thirty-fold in the US) appears to be explained by a combination of factors. Firstly, the entrepreneurial route can ease frustration associated with having dyslexia in the corporate workplace, and can lead to faster career progress. Secondly, starting their own companies afforded opportunities for entrepreneurs with dyslexia to better organise the work environment and bring in others to complete specific tasks they find difficult. Thirdly, by applying coping strategies developed when young, and by not being afraid to trust their instincts, entrepreneurs with dyslexia can steal a match on non-dyslexic peers and rivals. Whilst this paper has focused on entrepreneurs with dyslexia it is likely that many adults with dyslexia employed in the corporate world may also have similar skills as

a result of growing up with and coping with dyslexia. Communication and leadership skills are vital for any business and perhaps if organisations could foster an environment that allows those with dyslexia to have more control over their work place, their strengths could be used to benefit their organisations.

Graduates with dyslexia should perhaps look for organisations who offer them a degree of control over their work environment.

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# **‘I never remember a face’ - A Day in the Life of a Prosopagnosic**

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## **Introduction**

I invited Alice to see a film the other day. She was not effusive in her response, ‘Oh no, you wouldn’t want to go with me. I will be asking you who everybody is every five minutes.’ I laughed, commented that I too was not that good at recognising people, and arranged a time to meet.

Alice was right. Throughout the film there was a constant stream of whispered questions - ‘Who’s that?’; ‘Is that Martin?’ - and when two women both with long brown hair appeared on the screen together for the first time, ‘So they’re different people? I thought they were the same.’

Although I was too distracted to gain much from the film, what Alice told me afterwards left a lasting impression. Alice was born with congenital or developmental prosopagnosia, a neurological disorder characterised by an inability to recognise faces. At its severest, people with prosopagnosia fail to recognise themselves. An inability to hold a mental image of a face means that when separated from their children there is no facial memory. Several years ago Alice fortuitously met a neuropsychologist who specialises in the area. Until that time she had not realised that what she considered her stupidity and social ineptitude was a recognised condition.

Alice seemed keen to share her experiences. She explained to me that as there is no effective treatment, she wants to raise awareness and understanding. I asked Alice if she would keep a diary for one day. These are her words...

## **Alice’s Diary**

So you want to know about my experience of prosopagnosia? It’s something I’ve always had and so something I’ve always had to deal with- sometimes well and

sometimes embarrassingly badly. I will spend one working day – a Tuesday before term starts - jotting down the situations it affects and my coping strategies:

I met a lady in the loo while washing my hands. She obviously knew me as her 'Hello, did you have a good summer?' was quite effusive. More likely a member of staff rather than a student as it's the week before induction week. Probably knows me at the university and not through home as no asking after family members. White hair, glasses, no particular clues. Quickly drop my eyes to see if she is wearing a staff badge – can't look for long as she'll think I'm looking at her boobs - she isn't. Good job actually as it is very difficult to surreptitiously read a name without it really looking like you are looking at boobs. Ask after her summer, again she gives no clues, so I dry my hands and say 'Goodbye'. I wonder whether to ask Sarah in the office if she knows her but people never seem to know who I am describing anyway.

An ex-police sergeant, Mike, rings, he's just started work at the university. I spent the day with him recently at the police headquarters. He gives me the room number and he's invited me for coffee. Can I remember him? No, only the uniform and that won't help now. Is there anything I know about him which will help me recognise him? He must be middle-aged as he told me he has two girls in their early 20s. Also probably quite fit (in the healthy sense not necessarily the attractive sense) as he was in the forces. He may be the only man in the room so that would be okay. I want to avoid the situation where he is outside the room and I say, 'Hello, I am looking for Mike' and he says, 'I am Mike'. I will just have to hope and be alert to any clues. I get to the door of the building and a man opens it. I quickly scan his face to see if there are signs that he knows me – there are and he is about to kiss my cheek so it must be Mike. Note to myself for next time – he has curlyish, sticking-up hair with grey bits.

Someone is coming to see me at 11.30ish. I run it through in my head. I think I'll recognise her by her fuzzyish, long blonde hair. She did have eczema on her face last time -hopefully for her sake that has gone now but that will be one less clue for me. It'll be okay, though, because I know roughly the time she's arriving and she'll probably go to the reception desk first, so long as I don't go outside the office around then and meet her in the corridor. My desk is very well placed. It's in the adjacent room to the reception area and I can clearly see and hear people without them noticing me, unless they turn their head 90 degrees. That means I have a bit longer

to gather my clues from clothes, their voice, glasses, way they walk etc. and, best of all, I may well overhear them giving the receptionist their name. I can then come forward and greet them confidently.

I did recognise my visitor and we go for coffee. A man is carrying a tray and he looks familiar. I look at him and allow our eyes to meet for a split second – timing is crucial, not too long or he'll wonder about me but long enough to read his face. There is no flicker of recognition so I obviously don't know him. I look away and resume conversation with my visitor.

I go to M & S. A lady in the queue says 'Hello' and then sticks her face right next to mine. She must know me quite well then, or she's a bit mad. I look at her for a few seconds and then realise it's Tracey. She says, 'It didn't take you long this time' and laughs. She knows – it's such a relief when people know, and when they understand. Being diagnosed was a huge benefit as I can tell people with confidence rather than saying, 'I have a bit of a problem with faces', and them saying 'So do I' and me thinking, 'You don't really get it and when I totally ignore you next week, or even in ten minutes, you're going to be one of the ones who thinks I'm stand-offish or arrogant'. Back to Tracey. She was the next door neighbour and the receptionist at work and I never realised they were the same person. I only found out when my husband came to collect me and was chatting to her and I asked him how he knew her. I've not recognised her several times since then but she's good at telling me who she is, and now I know her reasonably well anyway, so long as she doesn't change her hair!

Tamsin rings from a local college. I know her name quite well and I know we have a similar job but have we met, and how well do I know her? Not that well but I suspect we have met. I look inside my head to see if I have any recollection of her appearance – absolutely nothing, just a name floating around without a face. I wonder if she's a member of a group I set up. It doesn't matter but it would be nice to know. Maybe she'll ask about the next meeting – she doesn't so out of curiosity I'll check my email distribution list later. She's bugging me as she kept calling me 'lovey' and 'sweetheart' as if she does know me quite well – although if she really knew me she probably wouldn't call me that.

I wish I had one of those telephones where you could see the face and the name popped up. I would love to talk on the telephone and be able to see the face. I am sure if I could see the face and I knew the name the whole person would drop into

place better, for example I would know if Tamsin attended my group or not, and I would be able to remind myself what Mike looked like before I set off to meet him (although I would probably end up running everywhere before I forgot again!) If you have no picture of a face in your head, there is less to attach information to. Maybe it would help if everyone wore a name badge, but well away from their chest. The trouble with name badges, though, is that it won't be long before I have to say, 'Excuse me a moment while I put my reading glasses on'. They would then know that I had no idea who they were. Maybe it should be me who wears a label. It could say, 'Hello, if you know me, could you just remind me who you are?'

**Useful website addresses:**

[www.faceblind.org](http://www.faceblind.org) The website of the Prosopagnosia Research Centres at Dartmouth College, Harvard University and University College London.

[www.icn.ucl.ac.uk/facetests/](http://www.icn.ucl.ac.uk/facetests/) On-line tests for assessment of face blindness in adults

<http://www.choisser.com/faceblind/> An on-line book on face-blindness by Bill Choisser, a face-blind man who investigated the condition as a lay-person in the late 1990s.

# Students Experiences of Maths elements of STEM subjects

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## Introduction:

There has been an increase in the number of students with reported SpLDs entering higher education. In 1994-1995 the number of students with dyslexia entering higher education was 0.48%, by 2004/2005 it had risen to 2.47%, according to the Higher Education Statistics Agency. Furthermore, some STEM courses appear to contain a high number of students who are dyslexic. Richardson and Wyndell (2003) found that in 1994-1995 engineering had one of the highest number of students who were identified as having dyslexia, with a prevalence of 0.74%. This is also evident in some other STEM subjects, for example physical sciences had a prevalence of 0.70%, whereas medicine had a lower prevalence at 0.24%.

This paper will consider the experiences and views of two STEM students who are studying towards science and engineering degrees. The students are currently enrolled on courses containing a strong maths element and will be graduating in 2014. Joel Rowlands is a second year biology student, who is about to enter a placement year; James Ashton is a first year aerospace engineer student, who will specialise in aeromechanics.

The paper will consider prior knowledge and ability; issues faced on degree courses; steps students can take to improve their maths; and ways lecturers can help students with SpLDs who are struggling with the maths element of their course.

## Course selection:

Both student authors of the paper felt that experiences relating to SpLDs had a large impact on both choice of degree and module choice within the degree programme. This was particularly believed to be the case with mathematical elements of the course. A strong maths foundation was seen by these students as highly beneficial

in STEM subjects. James Ashton discusses how his prior educational experience has influenced his learning.

“I returned to further education after a very difficult few years. During my teenage years I was diagnosed with cancer, massively impacting on my education. I beat cancer twice, but it has left me with lasting health problems such as fatigue, and has made it difficult for me to sustain my concentration over large periods of time. The route for me as an adult learner was to undertake an access course, which would allow me to gain entry to an engineering course. While the course did provide me with a good grounding and enabled me to enrol on an engineering degree, I feel that it did not give me the foundation in maths that I need on my course. The students who all did A levels seem to have a much stronger grasp of mathematical concepts and are able to understand and apply mathematical models much more easily. I feel like I am always playing catch up and that the maths foundation will become even more important as the course demands increase.”

This issue was also raised by Joel Rowlands who explains how avoiding mathematics can limit opportunities and progressively narrow module options.

“Of all the sciences, I think that biology is the one with the least maths involved. This means that students who struggle with maths will often select biology for further study. As maths is not a pre-requisite for biology, many students will drop maths before A level. The problem with this is that there is still a lot of maths in some parts of biology. If you avoid modules with a lot of maths, it can mean that modules in the second and third year are not available to you. This means your degree choices are narrowed before you’ve even started. As a student with dyslexia, I sometimes have difficulty understanding what is being asked of me in maths, but I think it is really important to work on this, rather than just avoiding maths and hoping for the best!” Both contributors have highlighted a pertinent issue regarding mathematics support for students with an SPLD. Jones, Williams and Bhojwani (1997) found that secondary students with learning disabilities would often fail to make progress in mathematics.

There was some evidence to substantiate the students’ concerns that student with specific learning difficulties could not have the foundations in place when tackling maths at university level. Richardson and Wyndell (2003) found that students with dyslexia had been admitted to university with lower qualifications than those with no reported disability. They argued that this could be attributed to low achievement in

primary and secondary school. Further, Sheppard (2009) discovered that in a comparative study of 1600 students dyslexia students would achieve lower grades in exams, including GCSEs and SATs examinations.

Finally, in terms of students avoiding maths, Macdougall (2009) commented that medical students were often unconvinced of the need to learn how to analyse statistics and were concerned that the time taken to develop this skill would impact on their research performance. Equally, Ashcraft (2009) found that the higher the anxiety, the less likely a student was to seek further maths courses; thus demonstrating that maths anxiety can have an impact on decisions regarding course and modules options, and, ultimately, career path.

Issues students may face:

Here the students discuss specific issues that they felt would cause particular difficulties for students with SpLDs. Joel considers the key difficulties in biology; some of these issues can be identified as affecting students with a dyslexia profile and incorporate dyscalculia indicators.

“I think biology is an interesting science in that a student can get to a certain level without having a great grasp of maths and, more importantly, maths concepts. The student can often use the equations and models provide to get the answers they need. In a way the students are following a recipe without really understanding how it works. The problem with this is when the student needs to go beyond the recipes, for example adapting a model or equation. This is when the students can come unstuck, as they simply do not have the skills or the underlying understanding to fall back on. A related problem is that the students may find it difficult to make predictions or realise when a result looks wrong because a mistake has been made. I think that the conceptual understanding of models and mathematical concepts is vital as the course progresses.”

“This idea of working beyond the recipes becomes more pertinent as the student becomes a more independent learner. When the student begins to gather their own data they need to make decisions at every stage of the research. These decisions include, deciding on parameters for data collections, handling the data, data selection, choosing an appropriate statistical analysis package, making connections, considering how to represent the data and analysing the data to reach conclusions. All of these skills require both maths and English skills and confidence. It is here that the difficulties that dyslexic and dyscalculia students have an impact on success.”

“Another issue that I have found challenging is determining what I am being asked to do. Sometimes the maths is wrapped up in almost impenetrable English! As a student with dyslexia I can find it very difficult to follow complicated explanations and worked examples that omit steps. I find this especially difficult when the lecturer is explaining equations without contextualising them.”

James adds to the issues identified, incorporating issues he has encountered on his engineering course. He discusses how, post A level, the maths becomes increasing specialised and course specific.

“The problem with maths elements in engineering is that they can’t be presented in a cohesive way. This isn’t a criticism of the course, it’s just that running a generic maths course would not be sufficient at this level. The maths is very specific to individual modules and needs to be presented alongside engineering concepts. Each maths principle is therefore dealt with as it becomes relevant. For me this is difficult as I feel I never really get into learning the maths, often just as I think I’ve conquered something a more complex idea is presented. It is like I am never on an even keel. With my tiredness, keeping on top of understanding the maths can be really difficult. I liken it to a rollercoaster. When I’m struggling with a concept, I get exhausted as if I’m climbing the rollercoaster. When I master the concept though, I’m exhilarated, like I’m swooping down the rollercoaster. Problem is, once I’ve conquered one hill, there is another, then another, then another. It takes a massive amount of time and energy to keep up.”

The issues highlighted by James and Joel are explored by Hewson (2011), who identifies two key issues. Firstly, the students don’t have the maths knowledge, and secondly, that they couldn’t apply their knowledge. Hewson found the reason for being unable to apply knowledge included over procedural thinking, ie the recipe approach; an inability to translate mathematical thinking to real world thinking and vice versa; a lack of multi-step problem solving skills and a lack of confidence. This is an issue raised by Trott (2010) who identified that students who lack an intuitive grasp of number relationships will often work mechanically by following mathematic procedures, without developing the underlying skills.

Steps students can take:

Both Joel and James discussed the ways that students with SpLDs can work to address these issues. Joel explains how students can use study strategies to improve their maths.

“I think one of the most important things a student can do is identify what exactly they are having difficulties with. Just saying you can’t do maths is not helpful, probably not true and doesn’t give you a starting point. Once you have sat down and worked out what you need to focus on you can start to address it. Don’t be afraid to start with the basics, you can start with an A level text book or even a GCSE one and work your way back up. It’s all about getting the foundations in place and building from them. There is also lots of support offered by higher education institutions, such as dyslexia tutorials and drop in maths sessions. Using these services can make a massive difference to improving your maths. They can show you different approaches and strategies such as using flash cards to learn and memorise equations. Considering different ways of doing things lets you play to your strengths, for example starting study groups or making resources to reinforce concepts.”

James also emphasised the need to address areas of difficulty and build a strong foundation of mathematics. He continues by considering the importance of reviewing and over learning of material to ensure maintenance of skills.

“The one thing I would say to anyone who is struggling with the maths element of their degree (whether having an SpLD or not) is to face the problem; it’s not going to disappear and winging it just stores up the problems. Even if you can get by and pass your modules in the first year, it is likely that you won’t be able to get away with this as the course progresses.”

“First things first, know what you don’t know; isolate the point at which you don’t understand something and start from there. It’s not about being able to answer one question but understanding how you got the answer, so you are able to adapt your learning to other scenarios. To do this seek out people who can help you, be they academic mentors, drop in maths or lecturers. I find academic mentors particularly helpful as they don’t just work on the question provided. They make sense of it and break it down so the student can fully get to grips with the concepts.”

“Of course with maths, it not enough to do something once, you need to work on your skills and develop them. Think of it as riding a bike. If you maintain your bike, oil it, keep the wheel pumped up, you can jump on it and ride it. If you leave it out in the rain though, it gets rusty and stiff. You can recognise it as a bike, but you are going to have quite a lot of work ahead of you before you’re going to get to go out for a ride! Steady maintenance is the key, if you are feeling tired and not very motivated, still do something, but choose an easier task! It could be practising worked examples or just

re-reading lecture notes, but these are the things that will help you to maintain your skills.”

Both students consider the importance of working on maths issues, even if they are challenging. They acknowledge the need to confront maths, isolating the areas to be worked on, rather than considering themselves to be unable to do maths. This isolating of the component parts of maths has been considered by Dowker (2004), who identified the components of mathematical knowledge as having the ability to carry out mathematical functions, understand arithmetical facts, understand and use arithmetical principles, and apply mathematical knowledge. A similar model is McKlosky et al's (1985) model which divides maths skills into three groups, calculation, understanding of number concepts and the production of numbers. The models are useful as they isolate specific mathematic difficulties, ensuring that students who have specific difficulties with maths are identified. By considering the students specific areas of strengths and weakness the students can target their learning and address areas of concern.

Screening tools can be useful in identifying the students' strengths and weaknesses in the different components. Beacham and Trott (2006) have developed dyscalculium, a screening tool to identify which maths elements are conceptually understood and which functions can be executed. This can be used as an effective starting point in planning a student's targets and learning plan. When developing a plan it is vital that the specific learning differences are considered and addressed. As Crabtree (2010) argues, it is the difficulties that inform us of how to use neuro-diverse activities.

Joel and James also identified using different strategies and learning styles. Kendal (2008) recommends the use of multi-sensory learning methods to support students to make the transition from concrete activities to abstract concepts and allowing more time exploring the concrete level. Multi-sensory learning is also recommended by, Miles and Miles (1992), who suggest that concrete aids such as cuisenaire rods and dienes blocks can help in the transition from concrete to abstract ideas. Again, Miles and Miles highlight the importance of over-learning and consolidation, arguing that a programme needs to be well structured to ensure that each stage has been learned and over-learned, before the student progresses.

### **Steps lecturers can take:**

Joel and James both considered addressing maths difficulties in STEM students to be a collaborative effort and valued the support of their lecturers. They discussed how this support could be instrumental in improving their maths. Here Joel explains how maths can be approached in lecturers to support students' learning.

“One of the things I have found most helpful is when lecturers focus on the overall concepts rather than just giving the maths. One example of this was when I did an experiment about species richness in transition zones, where I calculated biomass in transition zones, using three different methods. The maths was presented in the context of a scenario which had meaning to me, so I could make sense of the maths and learn it in the real world. I was able to make sense of the data I'd collected, select the appropriate data and extrapolate meaning from it.”

“Worked examples are also really useful. Sometimes lecturers assume a certain level of knowledge and abbreviate some of the steps, but providing each step can make a great deal of difference in supporting students' understanding. Equally, maths workshops could be offered for key concepts, after all workshops are provided for dissertation writing. This would provide an opportunity for students to improve their maths and, just as importantly, would reduce the stigma some students feel when they find the maths difficult. The workshops would be a way of acknowledging that the maths concepts can be difficult and that students are encouraged to seek support.”

“Finally, one thing that can make a difference to reduce students' maths anxiety is use of language. One example of this is when lecturers use terms like, here's a simple model. The first thing you think is, “if that's a simple model, what are the complex ones going to be like!” It can erode confidence when you need it most.”

James also identified issues with maths anxiety and explores the balance between supporting students and encouraging them to become independent learners.

“When you do courses such as Btecs and A levels, you get lots and lots of support; once you get to university; the emphasis is on you to become more skilled in developing your own skills. Sometimes though, students can feel that that should come to university with all the skills they need ready in place. This can make them feel that they shouldn't ask for help and worry about being stigmatised, because they can't do the work on their own. Lecturers can help students to understand that the students are not expected to be able to everything straight away, but that being

challenged academically and overcoming difficulties are all part of the learning experience.”

“One way to do this is to look at the maths support students are offered and how this related to engineering. Stand alone maths courses are a great start, but I think that academic mentors who are specialists in engineering are even better. The mentors don’t just answer the question you present them; they work with you to determine where you get confused and use that as a starting point. As well as academic mentors, engineering specific resources are particularly useful in developing the maths skill foundations needed. Sessions that support students in finding their own resources can empower students to take control of their learning and identify areas that they need to work on.”

As both students have highlighted, tackling maths issues requires both support in working on maths foundations and tackling issues of maths anxiety. Perry, cited in Henrich and Lee (2011) identified that this is often an issue for higher education student in STEM subjects . Maths anxiety is described by Ashcraft and Faust (cited in Trott 2009) as strong feelings of anxiety or dread when confronted with maths. Strategies to address maths anxiety were investigated by Usop et al (2009) who found that nine strategies were useful in addressing maths anxiety; they include seeking support from tutors, peer support groups, extra maths study time and additional learning materials; supporting Joel and James’ view on specific maths support.

Conclusion:

The experiences described by Joel and James highlight the issues surrounding how maths components in STEM subjects are addressed. As has been discussed by Joel and James, anxiety regarding maths elements in courses can limit course and module choice, and ultimately narrow course options available. Maths anxiety has found to be prevalent in higher education and can be tackled through strategies such as peer support, academic mentoring and support from tutors.

Both students discuss how students can work on these issues and utilise university support systems to address areas for further development; considering the importance of identifying support required in order to develop the knowledge and skills to progress on their chosen course. By addressing these areas, students can build a strong maths foundation, which was felt by the students to be instrumental in

achieving success in STEM subjects, especially after the first year when course demands increase.

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# **It's not what you see, it's how you see it.**

**Simon Beard**

## **Introduction**

Simon Beard specialised in mathematics and science throughout his secondary education but has since moved through the social sciences to a PhD in ethics and the philosophy of science. He discusses how his approach to learning with a severe visual impairment has given him depth at the extent of breadth and has led to this transition in his studies.

More or less my whole education has been mediated through a keilor lens, a small, but very powerful, magnifying glass that sits on the front of a pair of spectacles. With it I can overcome my significant visual impairment and read any text or see any detail that others can see, in-fact I probably see slightly more. With it, on the other hand, I can only see a small fraction of the field of vision that others can see, just about enough to cover the word fraction in this size of text.

Without a doubt this lens has given me access to education I would have struggled to receive otherwise. The fact that I do not depend upon Braille or any substantial piece of technical kit (e.g. CCTV or audio playback) means that I can access whatever I want when I want. However my keilor lens has not just changed what I can see, it changes how I have learned and what I have been able to do, and just as with its effects on my vision it has given me depth in exchange for breadth.

One way in which it has done this is very simple. Only being able to read one word at a time, and having to move my head across a page rather than my eyes means that I read far more slowly than most people. Depending on conditions I usually read slightly slower than people can read out loud. I have therefore read a lot less than most people of my educational level, and especially a lot less non-fiction. On the other hand since I am physically incapable of 'skimming' a page I tend to get a lot more out of the things I read and remember them a lot better than others, so that I have a more in-depth knowledge of the core texts in my subject than many of my contemporaries.

This much is relatively straightforward; however I want to focus on two other ways in which my visual impairment has given me depth at the expense of breadth. The first of these is in relation to many of the ways in which we express the relationship between ideas, in particular complex formula, graphs and diagrams. The limitation of only being able to see part of a formula or part of a diagram at any one time has prevented me from making good use of these tools, and has fundamentally altered the way in which I understand mathematics and science.

It is not that I am un-mathematical, I like numbers and find diagrams very useful, however they must be simple, small enough to fit into my field of vision, or else they must be expressed in ways that are not visual. Translating a graph into a series of movements has always made it much easier for me to understand, as has breaking down the numbers and letters of a formula into their component ideas. When I was learning statistics I could neither understand nor use the formula for producing a standard deviation until I first understood what standard deviation was and why every component of that formula was there, then it was no problem. Similarly I have always suffered from mistakes in understanding and interpreting information that was given to me in big diagrams or long equations, I lost a great deal of marks in my GCSE maths paper because I misread a single figure in a long equation as  $2x$  rather than  $x^2$

It is not only in my use of formula and pictures that this trade off between depth and breadth has affected by ability to learn and understand. It has also severely affected by spelling and certain features of my spatial awareness. It has been diagnosed as 'acquired dyslexia', but to me that is simply a medical term that is useful for putting on forms, the fact is that I don't quite see things in the same way as people who lack my visual impairment and my way of dealing with it.

This brings me onto the final way in which I have exchanged breadth for depth as a result of my disability. I no longer study Mathematics or Science directly, but instead I work in philosophy. My specialism is in the philosophy of science and the social sciences, and the interrelationship between science, ethics and public policy. This involves dealing with many of the concepts and ideas that I have come across whilst I studied science and mathematics, uncertainty, risk, optimisation, objectivity and the scientific method. However I now deal with these concepts as fundamental ideas to be dealt with directly, rather than as considerations to be taken account of along side practical empirical results. I still read scientific papers on a regular basis, and engage

with them in my work, but it is an engagement that involves going deeper to analyse what they are really saying, and cannot directly build upon the breadth of research that builds up the scientific corpus. Because I required a deeper understanding before I could interpret the everyday tools of science and maths I have come to focus on just these thorny issues that come from that understanding, and that has meant moving away from science and mathematics, much as I enjoy both subjects. In one sense this is a real success, since I can study what I understand and apply it to what I love, and I feel I am making the best contribution I can to real debates in science and in policy. However, in another sense it is no success, since what it shows is that, at least in my case, there is not accepted method of working within science and mathematics that can substitute spatial visual tools for other means of understanding and expressing relationships. That can be a real problem for a visually impaired person and has been a significant barrier in my own attempts to work within science and mathematics. I come from a family of engineers and I often think that had I been fully sighted I would have become an engineer myself. However, I am very much aware that in that case I probably wouldn't be working on the deep and fundamental questions that I am able to engage with in my philosophical research. I love philosophy, and although I regret having to sacrifice breadth for depth, in my vision, my reading, my ability to interpret formula and diagrams and even my entire area of understanding, I thoroughly enjoy my research and the depth of reading, interpretation, understanding and even vision that it gives me.

# Science learning and dyslexia – how I learnt to be a dyslexic scientist.

David Hopkins and Christina Healey

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University of Sheffield Dyslexia Team

## Introduction

David Hopkins was identified with specific learning difficulties at an early age. He has just completed a degree in the Department of Plant and Animal Science at the University of Sheffield and is preparing for his PhD. Here he discusses the positive aspects of his dyslexia and also the particular learning challenges involved in studying science and how he overcame them.

This article originates from an interview that David Hopkins gave to Christina Healey, a member of the University of Sheffield Dyslexia Support Team, in June 2011.

Science and diversity

I've always wanted to be a scientist. My dad's a botanist and I grew up being surrounded by science - running round fields. It was definitely the right choice for me to study science at university. I've got a lot out of it both personally and for my own perception of myself as a scientist.

Science needs diversity and having dyslexia means that you do things differently to everyone else. But I'm not going to lie; it does make things quite difficult. Science students need to know how to write really well and they need to process lots and lots and lots of information. There is not a massive amount of guidance on how to write or on how to structure your language. Things that are intuitive to everyone else aren't that obvious to a dyslexic student. I've had to learn for myself how to structure my work and this means I work better because of dyslexia even though it makes it harder.

## Learning at school

I was identified as dyslexic very young. My mum's a teacher. When I was in primary school I was quite slow picking up language. I got an assessment and I had some support early on. I've always had computers and extra time in exams. It has made a big difference being diagnosed early and having a family that was supportive. Until I started Uni I didn't need that much support because my family could do most of it. I don't know what I would have done without that. My organisation skills come from my parents which is the only reason why I function.

### **Learning at university**

I had the attitude for first and the first part of my second year that I would see how far I could get on my own without asking for help. I made use of extra time in exams and I got a dictaphone which saved my life. Even though I used my laptop to take notes in lectures there were times when I just couldn't keep up and I would not have got the point without my dictaphone. And it helped in revision as well.

### **Reading science**

I self-taught myself how to read science during the course of my degree. If I didn't like reading and what I could gain from reading I wouldn't do it because the process is quite painful. It takes me a long time to finish a book. I've never been able to skim read that well. I see halos round words and I didn't realise until I had my assessment for uni that that was part of my dyslexia. Recently I've started reading on coloured paper because I had so much to read for my exams and it's helped me process a lot more.

Some scientific writing can be really garbled, some scientists write really badly and you have to learn to read round that. Academics don't read the whole paper, they just read tiny sections so you need to know where to look. Journals have a lot of standard phrases that they overuse because scientists know what to expect from them. So they can be quite dull stylistically. I think that's what sometimes makes science a bit impenetrable. Which is a pity because good science shouldn't be impenetrable.

There's loads of information out there about how to read better but no one has time to sit and read it all. Perhaps departments could use tutorial time to teach students how to do scientific reading.

In my second year at uni I hit a big wall

Most people pick up how to write from reading but I've never been able to do that. Right up until my second year a lot of my exams were multiple choice or short answers. Those were things that I could do quite well because I didn't have to organise words and I didn't have to process lots of things. About half way through the second year of my degree this all changed. The new demands were essay writing and, in the third year, writing large projects. My marks tailed off dramatically. I always understood things a lot better by grasping the broad concepts not by remembering lots of tiny little facts and figures. But when it came to trying to articulate what I understood in words I just hit a big wall. It was frustrating because I knew things and yet I was getting poor marks.

I think my department understands that writing is important but the way the whole degree is structured is based on the assumption that students can just write instantly. If it's really necessary to have all this writing then departments need to persuade students to get help early on. It would be very nice to have a 5 credit module on scientific writing at the beginning of second year. Students don't want to learn half way through third year how to write properly because they've already lost all those marks in second year and third year

### **Writing science**

In science you don't have to read the whole sentence to understand the important parts. So you don't pick up sentence structure from just reading. I've had to teach myself how to write. Scientific writing needs to be precise and it needs to be clear and it needs to be regimented so that people know where to look for the information they want. There are niggly little points of style that distinguish scientific writing from normal writing. Scientific writing is amazingly anal you have to know why you don't put things here or how you have to take great care there. They are just small rules but they build up to make it garbled if you don't follow them.

Just one example. When you have tons of little facts that relate to each other it's quite easy to end up with a really confusing paragraph. One of the most useful things I've learnt about writing this year is how to use roman numerals. You can say "this may include or this may happen because . . ." and then list them using these numbers. It's also really nice to read because it tells you the individual points that you need to remember and you don't need to search the text for it. I don't think you would ever use that in English or History.

My dyslexia gives me an incentive to improve my writing so that I will become an above- average writer not a below- average writer. It is interesting as well when you get into the details of how language works, what it actually means to talk and communicate, how devices such as grammar can create different thoughts and different meanings. Language is integral to evolution and it should be sold as something that's interesting to scientists.

Making use of the help available

I read *From research to manuscript: a guide to scientific writing* ([Michael Jay Katz](#) (Springer, 2009) before I did my undergraduate project and this was one of the reasons why my project was good.

I started to use the support services at uni properly in my third year. I used a proof-reader. I didn't realise how useful it would be to have someone to give me feedback and to tell me why I'd gone wrong. I would try and write something to the best of my ability and then I'd send it off to my proof-reader and she'd email me back within a week. She'd ask questions like why did you put semi colon here and she told me loads of little things like referencing and points of grammar and why sentences were awkward. Lecturers were always writing 'awkward' on my writing and that's really meaningless when I don't know what 'awkward' means. Now I know what makes a good sentence I wish I'd used the service earlier.

I also started to use the study skills support. I avoided going at first because I was always scared to turn up and to say I need help but I don't know what I want. But it's been useful to have someone to structure something with. For me talking through something helps it make more sense. Then the rest is just lots of hard work.

In addition my department has a writer in residence. You just drop in. I've started using her quite a lot. She tells you about points of style. She talks about what sounds good and shows me small devices which are always useful to know.

### **Learning to learn differently**

I approach learning in a scientific way. There's quite a bit of psychology on my course so I've had to think about what language is and why it's evolved. Writing does not come naturally. We haven't got a gene for writing. We've got this innate ability to pick up spoken words and to process words but then to structure them into sentences. That's hard. Most people only started writing 150 years ago. That's not a very long time to really get used to it. Writing just doesn't happen for some people.

That's why it becomes difficult. If everyone has a way of doing something and you don't do it that way you're stuck. I just had to go out and find out how to learn, what works best for me, how do I organise all those messy thoughts. The process of doing this develops my thinking in a different way from everyone else and that's why it's important. In order to learn how to process information I've had to be quite creative. Once I've worked out why everyone else does things in a different way I can then apply it to other things like why does this experiment work and what is the process behind organising this theory. That's how I try and use my dyslexia in my research.

**Advice to a dyslexic student starting a degree in science.**

Don't let the fact that you can't write be a barrier to you. Start early. The earlier you start to get your head round how writing works the easier it is later on. You'll find that when you improve it helps with other stuff. Your thinking becomes better when you write better. The assumption that writing is irrelevant to what you know isn't completely just. Your ideas can be a messy jumble up there. If you're able to organise them and get that right then it will come so much clearer in the end. Clearer both to yourself and to everyone else. And don't think that dyslexia is a hindrance. You happen to have this different approach to what you do and that gives you an edge.

# **Journal of Inclusive Practice in Further and Higher Education**

## **Editorial guidelines**

JIPFHE has a refereed section which includes peer reviewed papers, and a practitioner focussed general section. Papers for all parts of JIPFHE share the common aim of furthering best practice to promote disability equality in post compulsory education (focussing on the whole student journey and transitions into FE and HE, and out, possibly to work; and the experiences of disabled staff). The main audience for JIPFHE is staff who work with disabled people in FE and HE and the journal should be of practical use to this constituency as well as enabling readers to gain a deeper theoretical underpinning in critical disability studies upon which to develop their day to day professional work. Based on the principle of 'nothing about us without us,' contributions from disabled students and staff are encouraged.

- Articles should be between 2500 and 6500 words, usually around 3,500 to 4.500. You may be asked to reduce the number of words even if your article is less than 6500, if the referees feel that you could express yourself more succinctly.
- Communication on your submission will be via the NADP office [admin@nadp-uk.org](mailto:admin@nadp-uk.org). (The paper will be sent on to the named editor for the edition who will be a member of the editorial board or a guest editor. Further communications will be with that person).
- Two referees, nominated by the edition editor, will review the paper anonymously and return their comments to the edition editor. The edition editor will either then contact the author about the outcome or liaise first with the series editor if there is not sufficient agreement between the reviewers. The outcome will be that the paper is deemed appropriate (usually subject to modifications) or unsuitable for JIPFHE.

- Refereeing takes time because of the liaison involved so please be patient. You will be given a reasonable timescale to make amendments.
- An abstract of no more than 300 words is required for research based articles (not for reflective pieces about personal experiences-which will mainly be from disabled /neurodiverse people).
- Contributions from disabled /neurodiverse people about their own experiences of post 14 education and training (in its broadest sense) are very welcome.
- Harvard referencing is required and at least 50% of your references need to be no more than three years old.
- Contributions should reflect ethical participatory /emancipatory research, which involves disabled /neurodiverse participants and results in interventions which improve services for disabled /neurodiverse people in the post 14 (education and training) sector.
- Ethical guidelines prescribe that research participants should not be identifiable, and confidentiality must be respected.
- A clear ethics statement is required.
- Language reflecting the social model of disability is expected.
- Articles must be original and should not be being considered by another journal when they are presented.
- Formats must be accessible to screen reading software.

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