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The investigation and evaluation of the support mechanisms offered to adults with a diagnosis of dyslexia in higher education study

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Abstract

This research had two aims. The first aim was to investigate the support mechanisms available to learners with dyslexia on programmes of higher education (HE), and the second aim was to assess the effectiveness of any inventions used to improve access to learning for this group of learners. Since the introduction of the National Student Survey (NSS) in 2005, efforts have been ongoing to improve the quality of the educational experience for students on HE programmes. Although the general trend in satisfaction scores is an improving one, this is not the case for learners experiencing disabilities. Around 43% of these learners will have dyslexia.

The research consists of two distinct parts. The first is a cross-sectional website survey and documentary analysis, and the second is a systematic review. The cross-sectional website survey and documentary analysis located and extracted data that detailed the learning support available to learners with dyslexia, from a representative number of higher education institution (HEI) websites in England. The systematic review analysed 10 single studies of experimental or quasi-experimental design and one literature review. These studies focused upon interventions provided to learners with dyslexia in higher education (and its international equivalents).

The combined findings suggest that support for learners with dyslexia in these settings is fragmented and inconsistent, and that there are many areas of existing practice that could be modified to improve opportunities for learning. There is an absence of any model of good organisational practice. There are examples of 'in-class' curricular adaptations and 'outside-class' additional learning and study skills support, including the use of information communications technology and assistive technology, which have shown some success in supporting the learning of those with dyslexia, but they are not implemented consistently or widely.

The investigation and evaluation of the support mechanisms offered to adults with a diagnosis of dyslexia in higher education study

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Appendix

The appendix to this thesis is presented as a separate document.

Glossary of terms

amanuensis	a person who acts as a note-taker or scribe on behalf of someone else
articulatory rehearsal	the process or repeating words or phrases 'out loud'
cerebellar	related to the cerebellum
congenital	present from birth
dysfunction	not working as it should
laterality	the control of specific functions by one side of the brain over the other
phonological	relating to sound
protocol	a set of recognised instructions or stages
remediate	an intervention to make something as it should be or to correct something
spatial	awareness of space and dimension
structured language programme	a programme that follows an explicit and prescribed pattern of delivery
syndrome	a set of characteristics that often appear together
temporal	related to time (and the passing of it)
visual	what is seen
verbal	what is said

List of abbreviations

ALS	additional learning support
AT	assistive technology
BDA	British Dyslexia Association
CONSORT	Consolidated Standards of Reporting Trials
CRD	Centre for Research and Dissemination
DA	Dyslexia Action
DDA	Disability Discrimination Act
DI	Dyslexia Institute
EPPI	Evidence for Policy and Practice Information
HE	higher education
Hefce	Higher Education Funding Council for England
HEI	higher education institution
ICT	information communications technology

LD	learning disability
MC	maths competent
MSL	multi-sensory learning
MST	multi-sensory teaching
PET	positron emission tomography
PICOS	Participants, Interventions, Control, Outcomes and Study Design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
NRDC	National Research and Development Centre for Adult Literacy and Numeracy
NSS	National Student Survey
RCT	randomised controlled trial
SCL	strategic content learning
SENDA	Special Educational Needs and Disability Act
SIM	strategic instruction model
SpLDs	specific learning difficulties and/or disabilities
STLR	Spam Limiting Tactile Reinforcement
STM	short term memory
TA	teaching assistant
UK	United Kingdom
QAA	Quality Assurance Agency for Higher Education
QED	quasi-experimental design

Acknowledgements

Dedication

I dedicate this thesis to my late father, who always loved, encouraged and supported me in my endeavours, even though he did not always understand them.

Chapter 1 Introduction

1.1 Background and study context

There are considerable numbers of students with developmental dyslexia on higher education (HE) programmes in England. In the responses to the 2010 National Student Survey (NSS), over 15,000 students identified themselves as having a learning disability (Higher Education Funding Council for England (Hefce), 2011). Additional evidence shows that around 43% of these learners will have developmental dyslexia (Richardson and Wydell, 2003; National Union of Students, 2013; Hefce, 2016). A more recent survey (Ryder and Norwich, 2018), which focused specifically on the student population with dyslexia, demonstrated that the number of students with a formal diagnosis of dyslexia, or self-identifying as having dyslexia, has been steadily increasing over time. In 2000, 1.2% of the student body claimed to have dyslexia and in 2016 this had increased to 5%. This is corroborated by current Higher Education Statistics Agency (HESA) data which, in 2018, listed 109,915 students enrolled on higher education programmes as having a specific learning disability. Rodger, Wilson, Roberts, Roulstone and Campbell compiled a report for Hefce (2015). This report stated that students with specific learning difficulties has increased by over one third since 2008/09 and in 12/13 this represented 6% of the student population, though this varied from institution to institution, in 12/13 the average proportion of students with dyslexia stood at 7.5%.

Although the general overall trend in satisfaction scores over recent years is an improving one, this is misleading in relation to students with developmental dyslexia. Surridge's (2009) analysis of the 2005–08 NSS data demonstrates that students with developmental dyslexia have a year-on-year downward trend in course satisfaction scores, which is statistically significant. More recent time-trial data analysis of NSS outcomes, which included all data from 2006 to 2010, corroborated this. In 2006, the global score for those who were 'learning disabled' was 3.8% lower than the global satisfaction score, and in 2010 it was 4% lower (Buckley, 2011; Hefce, 2006, 2011). The Hefce (2015) report examined aspects of student satisfaction for learners with specific learning difficulties; this report identified a number

of areas of the student experience which were less than satisfactory. Students expressed concern and discontentment about the lack of support they received from teaching staff; students claimed that they were not consulted regarding what their 'support package' contained and wanted more input. Students felt that, although central disability services in the institutions were supportive in providing individual learning agreements containing advised reasonable adjustments, these were generally ignored by their faculties. They also reported inconsistency in support between the support staff and the faculty staff. This evidence demonstrates, it can be argued, a less than satisfactory experience for learners with dyslexia. In addition to this, there is ongoing evidence (Hefce, 2015) that the attrition rate of students with dyslexia is a concern. It is notable is that students with dyslexia are more likely to withdraw in the first year of their study. They cite the significant factors leading to this as being both a lack of support and failure to cope with the demands of the programme (National Centre for Special Education Research, 2014; Richardson and Wydell, 2003).

This issue is coupled with the 'unavailability' (deliberate or otherwise) of 'success and progression' data for students with dyslexia at an institutional level. There is a lack of analysis of these learning-disabled students' academic outcomes in the United Kingdom (UK). This is unlike some of our international counterparts. For example, Australian universities (National Student Clearinghouse, 2014) disaggregate performance data for students with dyslexia from those with other learning disabilities or who are not disabled. The National Clearing House data, in 2014, demonstrated that the percentage of successful learners with dyslexia completing degrees in Australia is 34%, compared with 56% for the general population. This is a notable difference in achievement between the two groups, which may, or may not, be reflected in UK institutions.

Finally, the Hefce report (2015) suggests that a review of the support policies and practices for disabled students in HE is well overdue, as the last review took place in 2008/09, almost 10 years ago.

Regardless of whether an institution is performing 'well' in the NSS (or its international equivalents) the combined evidence, as outlined previously, suggests that the learning experiences for students with dyslexia are less than satisfactory, and therefore should be an area of focus for HE policy makers and practitioners alike.

The investigation completed for this thesis stems from my ongoing professional concern. I am a lecturer of some fifteen years' experience (seven in further education settings and eight in a UK Higher education institution (HEI)) with an ongoing interest in the learning and broader educational experiences and the successes and failures of students with a diagnosis of dyslexia. Personal experience leads me to believe that there are issues of dyslexia with regards to diagnosis: issues in policy development, and learning and teaching activity in relation to inclusive practices; issues with the appropriateness, content and delivery of additional support, as well as staff attitudinal issues exacerbated by dyslexia being a 'hidden disability'. This research sought to explore some of these areas in detail with a view to influencing future UK policy and practice at best, and as a minimum, to advise changes in learning and teaching practices at an institutional, school, departmental and individual level to promote access to learning for students with dyslexia. These were the motivations and aspirations for the completion of the research.

There is plentiful research that explores dyslexia as a learning difficulty, and the issues that it can present with learning; however, the vast majority of this research focuses upon dyslexia in young children and early childhood. There is significantly less research that explores how dyslexia manifests itself in adults and how dyslexia impacts upon their learning experiences both generally and in HE. There is also a lack of research about *what* support is provided to these students, *how* support is provided to them and perhaps more importantly *the extent to which any interventions are successful.*

Two publications of note attempt to establish this to some extent. Rice and Brooks (2004) undertook a literature review (*Developmental Dyslexia in Adults: A Research Review*), which was instigated as part of the Skills for Life Strategy (DfEE, 2004) and funded by central government, which was at the time interested in raising the literacy, communication and numeracy skill levels of the adult population of England. As existing research about dyslexia and its impact on the basic skill levels of adults was fragmented, the literature review was commissioned. Its key purpose was to bring research together into one evaluative document that would make recommendations for future policy and practice development in England as part of the implementation of the Skills for Life Strategy. This literature review collated nationally and internationally published material that focused on a range of theoretical concepts of dyslexia and evaluated a range of learning, teaching and assessment practices designed to improve access to learning for those with dyslexia. The second significant piece of related research was more recent. This was 'The inclusion of students with dyslexia in higher education: A systematic review using narrative synthesis' (Pino and Mortari, 2014), which included 15 studies in its data synthesis. This study also sought to evaluate how inclusive teaching and learning practices were by evaluating a range of existing research, but in a systematic way. Although these studies claimed some useful and valid findings, the majority of the research included in the literature review and the systematic review was of case study design. Therefore, the findings of both of these papers provided insubstantial information regarding the extent to which any interventional practices in use were effective. This is because both reviews contained minimal research of experimental design and therefore could not evaluate for cause-and-effect relationships (Shadish, Cook and Campbell, 2002; White, 2009). Also, neither of these reviews collected data that identified any patterns of availability or consistency in the types of support offered to those with dyslexia on HE programmes in England; their focus was not broad enough to achieve this. It was the aim of this research to address these gaps.

1.2 Research aims and rationale

The problem identified, i.e., declining student satisfaction rates and high attrition for those with dyslexia, led to the development of two research aims. They were:

to investigate the support mechanisms that are offered to learners with a diagnosis of dyslexia on programmes of higher education in England; and

to identify and evaluate any interventional support strategies in use that may benefit these learners.

The rationale for the research was firstly, to identify gaps in how support for learning was planned and delivered for learners with dyslexia on programmes of HE in England at that moment in time; and secondly, to use existing national and international research of experimental and quasi-experimental design to evaluate whether any interventions that had been tried and tested with learners with dyslexia in HE had been successful. The research aimed to draw together the separate findings reflective of each research aim in order to come to an overarching judgement regarding: the availability of support for learners with dyslexia; the usefulness of the support, and whether the content of the support offered was appropriate. The research set out to establish any potential issues with support that existed and to provide some insight about areas that could potentially be reviewed and developed in the future for these learners.

This is an important piece of research, not because of the NSS results per se, but because of what the declining satisfaction data may be telling us about the experiences of learners. Having said this, one cannot ignore the increasingly public nature of the results and their impact upon the positioning of higher education institutions (HEIs) in national and international performance league tables. This has been a significant driving force for institutions in the sector to improve their student satisfaction scores (and arguably their attractiveness to students and other stakeholders), and subsequently their

league table position. A good NSS score is perceived as an indication of a good-quality learning experience (Turnbull, 2018), and although this is not the only metric on which league table position is based, it is a significant one.

1.3 Research design

The design of the research is distinctive. It consists of two independent pieces of research that used differing designs and different methodologies. They also had different data collection techniques and each piece of research had its own set of independent findings. Once the two pieces of research were complete, the findings were brought together via use of the 'triangulation protocol' (Farmer, Robinson, Elliott and Eyles, 2006), which enabled the comparison of both sets of findings to take place and for any cross-cutting meta-themes to be established (ibid., 2006). This merging of the data facilitated a critical discussion that reflected both sets of findings and allowed for one set of overarching conclusions and recommendations to be drawn. The design was structured in this way in order to enable both of the research aims, which required the collection of different types of evidence, to be met. The questions formulated to meet the aims of the research were:

i) What support mechanisms are in place for adults with dyslexia in higher education institutions?

ii) How effective are the reported interventions that are adopted to promote the learning of adults with dyslexia studying programmes of higher education?

To answer (i), a website survey and documentary analysis of a sample of HEIs were completed. To answer (ii), a systematic review, which limited its data synthesis to the inclusion of research of experimental and quasi-experimental design, was completed. This provided the opportunity for new ideas and knowledge to be formulated both separately and then together using a methodological and transparent approach to data convergence and analysis (Gorard and Taylor, 2004; Oliver, 2011).

1.4 Thesis outline

The contents of the additional chapters of this research are outlined briefly below.

Chapter 2 provides a theoretical perspective of developmental dyslexia via a review of literature. It establishes the thinking, from both research and practice, about developmental dyslexia as a specific learning 'disorder' or syndrome and considers various attempts to define what developmental dyslexia 'is' or 'is not'. It proposes a new definition of dyslexia for adults that is based upon research and practice. It also explores the differing viewpoints associated with inclusive learning and teaching practices for adult learners with dyslexia, including the role of information communications technology (ICT) and assistive technology (AT), in relation to their role in supporting learning.

Chapter 3 presents the outcomes of the website survey and documentary analysis. This answers the first research question and includes an evaluation of a proportionate sample of HEIs' website information. It analyses the textual data within them, which relates to the opportunities for learning support in place for learners with dyslexia on programmes of HE. The themes that emerged from this research assisted with the definition of the focus for the subsequent aspect of the research, which forms chapter 4.

Chapter 4 is the systematic review and answers the second research question. The systematic review was planned, designed and operationalised in line with the recognised good practice PRISMA (2009) guidance for the conduct and reporting of systematic reviews. It considered both national and international research. This chapter synthesises the findings from studies of experimental and quasi-

experimental design only as it was interested in research that would demonstrate outcome effects from specific interventions used to support learners with dyslexia on HE programmes (or their international equivalents).

Chapter 5 brings the data from both the website survey and documentary analysis and the systematic review together into a combined meta-thematic analysis using the triangulation protocol (Farmer, Robinson, Elliot and Eyles, 2006). It triangulates the findings from each independent piece of research against the other to highlight areas of agreement, disagreement and gaps or 'silence' across the data sets, (where silence indicates one set of findings is not reflected in the other set of findings). This allowed the discoveries made from the combined analysis to be linked to the theoretical perspectives discussed in the literature review (Chapter 2) and a discussion which reflected both to be undertaken.

Chapter 6 contains the conclusions of the research and presents recommendations for future HE policy and practice that are reflective of the discussions in Chapter 5. Chapter 6 also explores the strengths and limitations of the research and as part of this evaluation, identifies potential avenues for future research.

1.5 Conceptual issues

It is necessary to explore the conceptual issues that had to be considered and addressed during the conduct of this research. Developmental dyslexia is a specific learning difficulty identified by a pattern of observable characteristics that are present from birth (British Dyslexia Association (BDA), 2018). However, in UK publications, it is often cited as just 'dyslexia'. There is also a condition known as 'acquired dyslexia'. Acquired dyslexia is not present from birth and is often the result of brain trauma that happens after the skill of reading has been acquired, leading to alexia (The Dyslexia Trust, 2017). Generally speaking, acquired dyslexia is called 'acquired dyslexia' when it is being discussed. Where the term 'dyslexia' is used in research it is usually referring to developmental dyslexia, as is the case

throughout this thesis. In addition to this, many UK publications use the term 'specific learning difficulties and/or disabilities' or 'specific learning difficulties'. These terms are often used interchangeably with dyslexia and are also often used as all-embracing phrases that group dyslexia under an umbrella with other specific learning difficulties, such as dyscalculia, dyspraxia, attention deficit disorder etc. Specific learning difficulties of this nature are also categorised and defined in the USA as 'learning disabilities' (Rice and Brooks, 2004). This use of this differing terminology was considered through the process of the systematic review document search and is evident in the search strategy (Appendix H). A further conceptual issue that was considered during the conduct of the search for the systematic review is the differing terminology used to describe learners on post-compulsory education programmes in international settings that are equivalent to HE programmes in England. For example, in the USA, such learners are often referred to as 'college learners', and sometimes HE is called 'tertiary education'. This was fully considered in the planning and execution of the systematic review document search.

The findings of this research did not only establish some interesting findings; it also established potential areas for future research, which are explored in chapter 6.

Chapter 2 Developmental Dyslexia

2.1 Introduction

This literature review provides a conceptual and theoretical framework and facilitates the triangulation of the findings from studies 1 and 2 (which form chapters 3 and 4 respectively) against the knowledge in the field as discussed throughout this chapter. This will, in turn, assist in the formation of informed conclusions and recommendations for policy and practice which are reflective of the three chapters. The data synthesis, conclusions and recommendations are outlined in chapters 5 and 6 respectively.

This chapter considers developmental dyslexia from a range of viewpoints. It provides a historical perspective of what dyslexia is and how it is defined, proposing a definition developed specifically for adults. It also explores some of the dominant theoretical positions and discourse around the medical or 'deficit' models and social models of disability and how these may relate to the learning experiences of those with dyslexia on programmes of HE. This also includes a brief overview of the role of ICT and AT in supporting learning.

2.2 Developmental dyslexia: background

There is some agreement that developmental dyslexia is a genetically inherited condition (British Dyslexia Association, 2017) and present from birth, as opposed to acquired dyslexia, which can occur as a result of brain injury or trauma (Temple, 2006). Developmental dyslexia is diagnosed much more frequently in males than females (a ratio of 4:1); this has been evidenced through a generational pattern of reading failure (Dyslexia Organisation, 2018).

Developmental dyslexia is commonly cited as a 'hidden disability' and literally means 'difficulty with words' (Lee, 2002). It has been the subject of investigation in the fields of medicine, psychology and education since the late 19th century when Pringle Morgan (1896) could not explain the reading and

writing difficulties of an orally 'bright young man' in his classroom who had no observable disabilities and proposed the term 'congenital word blindness' as there was no other obvious explanation for his difficulties. Hinshelwood (1917) corroborated the existence of unexplained 'word blindness' as the absence of any obvious brain trauma in the subjects of his research also suggested that the condition was present from birth. Morgan (1896) and Hinshelwood (1917) are considered to be the pioneers in identifying the condition now known as developmental dyslexia.

Since then, there have been significant advances in dyslexia research, which have enabled explanations of dyslexia to be put forward. These have been used for the development of both educational policy and educational practice. Having said this, there is no global agreement or explanation that is accepted universally as to what developmental dyslexia is, or even whether it exists as a learning disability per se (Elliot and Grigorenko, 2014). Further to this, the identification of the dyslexic condition (and the development of new tests to identify dyslexia and its sub-components) is surrounded by controversy and debate. Despite this, a plethora of theoretical standpoints and conjectures remain in an effort to identify the underlying factors in developmental dyslexia, and in attempts to explain why some children fail to acquire reading (and writing) proficiency despite 'the usual' instruction being provided (Herrington and Hunter-Carsch, 2001), and why these difficulties can persist into adulthood (Elbro, Nielsen and Petersen, 1994).

As a result of these explorations, several different brain-related functional and structural issues have come to light that go some way towards explaining the dyslexia syndrome and some of its characteristics (Galaburda, 1999; Paulesu, Frith, Snowling, Gallagher, Morton et al., 1996). These serve the purpose of demonstrating the complexity and nuances of developmental dyslexia, but none is fully able to explain the pattern of characteristics observed for every individual demonstrating the 'unexplained' reading problems that have become known as developmental dyslexia (Klein and Krupska, 1995; Lee, 2002; Rice and Brooks, 2004).

The majority of the explanations put forward and discussed here are 'deficit' or medical models of dyslexia. This is for two reasons: firstly, the majority of explanatory theories of dyslexia are positioned within the medical model of disability; and secondly, despite the strategic change in direction that many HEIs have taken in publicly adopting and committing to the social model of disability (following the Equality Act 2010), research suggests that the majority of lecturers in higher education, who claim some awareness of the learning disability, still conceive dyslexia in a medical 'deficit' model (Mortimore, 2013). This indicates a tension between the HEIs' position as advocates of the social model of disability, and the lecturers working within them in relation to this specific learning disability. The findings of the systematic review (chapter 4) which critiques interventional practices across higher education delivery may also help to establish whether the interventions can be conceived as aligning more with one model of disability (medical/'deficit') than the other (social) and, if so, what the implications are (if any) for future HE policy and practice.

The discussion and findings in chapters 4 (the systematic review) and chapters 5 and 6 (data synthesis, conclusions and recommendations) may shed some light as to how these potential conceptual and theoretical juxtapositions play out in the reality of everyday support practice in higher education and any implications of this possible tension for the provision of good quality, appropriate support for learning.

Developmental dyslexia, within the medical model of disability, is viewed as the result of malfunction at the biological level, which disrupts cognitive function, leading to the language and literacy problems associated with the syndrome. These malfunctions are observed at the behavioural level as being predominantly a lack of reading, spelling and writing proficiency. There are, however, a range of additional underlying functional issues that are identifiable via diagnostic assessment as part of the dyslexic condition, which indicate the likelihood of dyslexia (Klein, 1993). The most frequently observed of these are: temporal processing deficits that affect the visual system (Stein, 2008);

problems with spatial awareness (Turner, 1997); limited short-term memory capacity (Gathercole and Pickering, 2000); delayed or slow auditory processing speed (Breznitz, 2008; Tallal, 1976); picture-naming deficits and visual–verbal coding delay (Swan and Goswami, 1997b); and the inability to distinguish rhyme (Bradley and Bryant, 1978).

The phonological 'deficit' hypothesis is the first to be discussed. This has ascendance over other hypotheses as it is derived from a significant evidence base that suggests that difficulties in phonological decoding (or alphabetic letter–sound correspondence) and phonological awareness (the ability to distinguish phonemes) are the key differences between those diagnosed with dyslexia (Everatt and Reid, 2009) and others who are simply considered to be 'common garden-variety poor readers' (Stanovich, 1988).

Ehri and Robbins (1992) proposed that, in order to read and write, children have to learn how to map the sound of the heard word, the sight of the written word and the articulatory sequence of the spoken word onto each other. To do this accurately, efficient phonological processing is needed. Some research suggests that children who find it difficult to distinguish sounds that are spoken or to manipulate sounds that are heard are more likely to have problems in acquiring the skill of reading than those that do not (Swan and Goswami, 1997a; Goswami, 2000; Snowling, 1987; Nation and Snowling, 2004; Vellutino, Fletcher, Snowling and Scanlon, 2004). It is also suggested by Rack (1994) that a phonological 'deficit' could explain why those diagnosed with dyslexia have problems with the accurate and fluent recall of phonologically coded items in memory; this has been developed into a sub-hypothesis of the phonological coding 'deficit' known as the Double Deficit Hypothesis (Wolf and Bowers, 1999). This sub-hypothesis suggests that there is a combination of deficits in accuracy and fluency in the phonological processes that appear to be apparent in learners with dyslexic impairments. These types of deficits are the most difficult to remediate.

Paulesu, Frith, Snowling, Gallagher, Morton et al. (1996) completed experiments using Positron Emission Tomography (PET) scans on adults with dyslexia. They identified that those diagnosed with dyslexia had an identifiable cognitive difficulty in phonological processing, which showed itself in a range of tasks designed to test phonological awareness and manipulation of sounds, such as spoonerisms, phonemic fluency and naming speed. These tests also demonstrated that the participants were significantly impaired in short-term memory capacity, demonstrated by poor performance in digit-span and other short-term memory tests. The research findings claimed that the anterior and posterior language areas in the left hemisphere of the brain did not work in the same way as in the control group. They theorised that this was due to an inactive insula which, when functioning normally, acts as a bridge between the two main language areas. They concluded that a defective phonological system, a frequently cited aspect of dyslexia, is due to a weak connectivity or 'link' between the language areas. They also proposed that the adults included in the experiments had a relatively advanced ability to compensate in some areas; for example, they performed in the average range in some tests of non-word reading, word and non-word repetition tests and on spelling. They also stated that adults with developmental dyslexia did not have the ability to use areas of the right-brain function to compensate for the language areas in the left hemisphere not functioning fully. This is unlike those with acquired dyslexia, where some right-brain activity had been identified by PET scans during the act of language processing, thus contributing to language processing in a capacity beyond that observed in those with developmental dyslexia.

In regard to issues with the representation of sounds and the written word (visual–verbal coding), Orton (1925) observed children with reading disabilities and hypothesised that they had failed to establish appropriate cerebral organisation to support the association of visual words with their spoken forms and coined the phrase 'twisted symbols'. This term stemmed from his observation that many of the children he studied tended to reverse letters or transpose their order in words. He suggested that this delay in children establishing hemispheric dominance led to a 'misfiring' of normal

language processing activity which, also according to Paulesu et al. (1996), should take place in the left hemisphere of the brain. Orton (1925) suggested that this lack of cerebral dominance was also evident in the delayed establishment of handedness and the claim that a greater proportion of individuals diagnosed with developmental dyslexia are left handed or ambidextrous, and that this issue of un-prioritised cerebral dominance can be directly related to the evident confused language processing.

The temporal processing 'deficit' hypothesis is also cited as a biological brain difference between those that have dyslexia and those that do not. Stein (2008) suggests that there is motor, sensory, psychological and genetic evidence that dyslexia is a neurological syndrome. Part of the evidence base of Stein's research concludes that the visual system (or the over-development of the magnocellular neurones in the visual system) affects how the written word is processed by the brain and interpreted, leading to visual disturbance and issues with word stability, for example, words moving or blurring on a page, words running off a page, the halo effect and so on. These are often reported as an issue for those with a diagnosis of dyslexia. In some cases, this type of visual disturbance has been remediated by the use of visual stabilisers such as transparent coloured overlays or coloured lenses in spectacles (Maclachlan, Yale and Wilkins, 1993; Wilkins, Evans, Brown, Busby, Wingfield at al., 1994). This view of dyslexia as a visual disturbance is contested by advocates of the phonological 'deficit' hypothesis, who believe that this aspect of language acquisition is more crucial to reading success than any other. It is argued that the success of remediation programmes that use phonological training methods to develop reading skills in the learner with dyslexia is inconvertible proof of this (Torgesen, 2002). However, this does not explain the visual disturbance that is sometimes reported as an aspect of dyslexia. Developmental dyslexia, therefore, has many facets that affect the visual or phonological systems (or both) to a greater or lesser extent. Some researchers have distinguished the two as 'surface dyslexia' (Law, 2015) in relation to visual processing issues; and 'deep dyslexia' (Buchanan,

McEwan, Westbury and Libben, 2003; Colangelo and Buchanan, 2006) in relation to core phonological processing issues.

The final hypothesis to be explored in relation to biological brain differences and dyslexia diagnosis is the cerebellar 'deficit' hypothesis. This explanation of dyslexia focuses upon motor deficiency as a key factor in dyslexia diagnosis. Fawcett and Nicolson (1999) claim that dyslexia has a much broader underlying skills 'deficit' than problems secluded to phonological skill development alone, and that this is as a result of a biologically structural difference in the cerebellum. They claim that the blood flow to this part of the brain is impeded by up to 30%. In their research, they suggest that there is a direct link between this underactivity and a delay in, or lack of control over, motor skills function and automatic motor skills development. This in turn impacts negatively upon processing speed capacity in the short-term automatic memory capacity, which, it is claimed by Fawcett and Nicolson (2001), is a necessary underlying function for normal reading development.

Both Frith (1992) and Snowling (1987) discuss dyslexia as a cognitive 'deficit', in that dyslexia stems from an inefficiency in automatic information-handling processes that converge on linguistic processes and the closely associated roles of auditory memory, word perception, linear sequencing, rate of articulation and auditory comprehension. Other aspects of dyslexia related to cognitive malfunction, such as limited short-term memory capacity (Gathercole and Pickering, 2000), delayed or slow auditory processing speed (Breznitz, 2008; Tallal, 1976), picture-naming (or visual–verbal coding) delay (Swan and Goswami, 1997b), grammatically poor oral language and difficulties in naming objects from the age of three (Scarborough, 1990); poor oral reading fluency (Fuchs, Fuchs, and Hosp, 2001) and the ability to distinguish rhyme (Bradley and Bryant, 1978) can all be explained to some extent by the hypotheses based on biological factors discussed previously. For example, visual–verbal coding and rhyming ability can be related to the phonological 'deficit' hypothesis, while processing

speed and a lack of spatial awareness can be related to the motor (or cerebellum) dysfunction hypothesis and so on.

The final area of note is the controversial discrepancy model of dyslexia, which had a major impact when it was proposed and is still represented today in some definitions of dyslexia. Rutter and Yule (1973) were the first to claim that there were significant differences between 'children with general reading backwardness' and children who were 'specifically reading retarded', the difference between the two being distinguished only by measured intelligence, or intelligence quotient (IQ). This was the first time that dyslexia had been differentiated as a specific learning difficulty rather than a general learning disability. To put it another way, the developmental reading delay exhibited in these children was 'unexpected' in relation to their general intelligence. This defining of the two positions was controversial as it suggested that only children with average or above-average intelligence could be 'labelled' as dyslexic.

This position is also viewed as controversial by some as the range of underlying skills associated with dyslexia, such as phonological awareness and short-term memory capacity deficits, are not affected in any way by intelligence levels (Siegel, 1992). From this perspective, it is argued by some that there is little point in differentiating between children with low IQ and delayed reading development and children with dyslexia, as remediation for both is the same (Stanovich, 1988; Shaywitz, Escobar, Shaywitz, Fletcher and Makuch, 1992). However, UK-based researchers such as Snowling (2013) advocate that the distinction between the groups needs to be maintained, not for reasons related to IQ (a relatively recent article states that IQ should not be used an acceptable factor in the diagnosis of dyslexia (Snowling and Hulme, 2012), but because those with dyslexia demonstrate a particular pattern of reading behaviours and that these are not evident in the same pattern in general poor readers. There is general agreement that individuals of all ages can demonstrate a cluster or pattern of characteristics that can lead to a formal diagnosis of developmental dyslexia, that dyslexia is the

outcome of multiple factors such as genetic and environmental influences (Pennington, 2006) and that levels of dyslexia are variable (Critchley and Critchley, 1978).

2.3 Developmental dyslexia defined

There are many different dimensions to developmental dyslexia. Reid (2017) suggests that it is a multi-faceted specific learning difficulty, which may explain why a single universally accepted definition has not yet been achieved. Others argue that the use of dyslexia as a label serves no useful purpose. Elliot and Grigorenko (2014), for example, suggest that so many children struggle to master the skill of reading that the application of a diagnostic label such as dyslexia is unhelpful. They suggest that if a child is attached to this label, there is an expectation from the child and his/her parents that there will be a clearly identifiable future path to assistance, which they argue is misleading. On the other hand, Dr. John Rack, formerly of Dyslexia Action, suggested in 2016 that to not try and establish the underlying causes of why some children struggle to read is a mistake, and that for many it is useful to have a label such as dyslexia where there is an identifiable pattern that can be characterised as such. Reid (2017) agrees with this notion, and suggests that definitions can serve an important function even if the educational value of them may be questionable. For many parents and teachers, a label is necessary as it can help to start the support process in compulsory schooling. For adults with dyslexia, it can help them to develop some self-knowledge of their abilities and issues with learning and the eventual development of coping strategies that can alleviate some of the symptoms (Reid, 2017). Snowling and Hulme (2012) suggest that if those with developmental dyslexia are not properly supported, it can have negative lifetime effects and impact on well-being into adulthood, since with poor literacy comes a poor education and with a poor education career prospects can be limited thus affecting overall quality of life.

It can be argued, therefore, that there is some agreement on the grouping of factors that can contribute to dyslexia on which these definitions are based, and that diagnosis, for some, can be

helpful (Dyslexia Action, 2017a; British Dyslexia Association, 2017). Both the British Dyslexia Association and Dyslexia Action are 'advocates' of developmental dyslexia and actively champion its existence as an identifiable and specific learning difficulty. These two prominent advocates in the field have produced working definitions of developmental dyslexia that are widely accepted and used for both educational policy and educational practice. Therefore, these two nationally recognised definitions of developmental dyslexia are used as reference points throughout this research.

The most similar aspects of the two definitions are brought together and summarised below, with the notable differences between the two identified and considered. Both the British Dyslexia Association and Dyslexia Action are in agreement that dyslexia is a specific learning difficulty that affects predominantly literacy and language-related skills. Both indicate that types of dyslexia are resistant to conventional teaching methods but can be remediated by specific types of intervention that are appropriate, including the use of assistive technology and information communications technologies (Elkind, Black and Murray, 1990). They both highlight the issues caused by deficient underlying processing skills characterised by measurable deficits in phonological processing, rapid naming, working memory and processing speed, and delay in the automatic development of skills. Both indicate that dyslexia is a genetic condition that has lifelong effects that can diminish self-esteem and confidence. The key differences, which reflect the ongoing tension that still exists around the discrepancy model of dyslexia, are that the British Dyslexia Association suggests that language and literacy skill levels may not match up with other cognitive abilities, whereas Dyslexia Action makes specific reference to intelligence not being a factor in dyslexia identification. Dyslexia Action also makes the additional point that they believe that dyslexia is a syndrome, a continuum, with no clear start and end points, while the British Dyslexia Association make no specific mention of this, although it is implied.

Whilst the summary of these definitions is useful, both the British Dyslexia Association's and Dyslexia Action's definitions are broadly focused. They cut across all age ranges and do not pinpoint in any detail how developmental dyslexia is a 'disorder' that presents a potentially different pattern of issues in adults as opposed to children.

Therefore, the following definition of dyslexia was developed to reflect these existing, accepted definitions. It also reflects existing published case studies focused on dyslexia in adults and the findings from these (Rice and Brooks, 2004). The proposed definition is also rooted in the research and the extensive anecdotal experiences and observations made following many years of practice in assessing for developmental dyslexia in adults. This new definition is important because it brings to light some of the most persistent difficulties an adult with dyslexia may face, as well as reflecting how experience and maturity can alter these over time:

> *Adults with dyslexia can have a reduced capacity to process and comprehend oral information that comes at speed. Reading can be slow and laborious with persistent difficulties in the application of phonic attack, though good comprehension can be evident. Writing is often disorganised and illogical with incorrect application of syntax and grammar; spelling is often a persistent issue. Adults with dyslexia can develop strategies that utilise key strengths and can help to mask areas of weakness; this is called compensation. Attention span can be limited, a factor compounded by reduced short-term memory capacity. Some adults with dyslexia have dominant right-brain function and therefore their non-language based 'knowledge' and non-verbal intelligence score is often higher than verbal intelligence on IQ scales. They can be highly intuitive. They often have self-esteem issues, lack confidence and do not cope well in stressful situations. Organisation skills, temporal processing and laterality issues can also be present.*

2.4 Developmental dyslexia, and teaching, learning and higher education

As previously suggested, the identification of developmental dyslexia, within the 'deficit' models and definitions explored, has limited and restrictive use beyond providing a label to trigger access to support and additional resources to promote access to learning.

A different perspective is to consider dyslexia from the social model of disability. This is a relatively new paradigm which contrasts the medical model and, as yet, does not have full universal acceptance and so is the subject of ongoing debate (Haegele, and Hodge, 2012). The social model of disability proposes that constructing solutions to barriers should not be directed at the individual, but at society (Haegele and Hodge, 2012). Educationally, within the social model of disability it could be suggested that a more practical and useful stance is the consideration of developmental dyslexia as a 'specific learning preference' that responds well when suitable learning, teaching and support are in place, and that adult learners with developmental dyslexia can achieve as well as other learners providing this is the case (Morgan and Klein, 2000; Richardson and Wydell, 2003; Smith, 1996). So, from the perspective of the social model of disability, the issue is not perceived to be the learners' difficulties or deficits, but the physical and non-physical barriers 'surrounding' the learner that impede access to learning (Powell and Tummons, 2011). Therefore, there is a potential for increased opportunities for learning for adults with developmental dyslexia that could be facilitated with adaptations to the way teaching is delivered and how the presentation of learning material is constructed, rather than focusing upon what may be deficient in the learners themselves (Klein and Krupska, 1995; Smith, 1996). However, critiques of the social model of disability (Haegele and Hodge, 2012) suggest that it is problematic as it fails to address impairment as an attribute that is an essential part of the individual's lived experience and it does not account for differences between individuals with different disabilities. From a teaching and learning perspective, this position could be problematic as the learners themselves may identify their disability as a medical 'impairment' that should be considered as such in relation to how it impacts on their everyday existence, and may themselves desire specific

remedial help which is appropriate to support their learning and academic progression. The very nature of disability itself, it could be argued, is an individual and personal entity. So, how is this reflected in current research about the approaches used to promote teaching and learning for dyslexic students in HE?

What is known is that the delivery of HE programmes does predominantly follow a traditional lecture and seminar pattern (Fry, Ketteridge and Marshall, 2009) and that around 90% of traditional classroom instruction is geared towards the auditory–verbal learner. To put it another way, most teachers adopt, by accident or design, the left-hemisphere (language-based) approach to teaching (Lee, 2002) and this is best suited to learning preferences that are analogous to this. If we take the research that suggests dyslexia is a specific learning preference dominated by right-brain processing at face value, those with dyslexia will not respond well to language-based approaches to learning (Paulesu, Frith, Snowling, Gallagher, Morton et al., 1996) and will often prefer the more 'right-brained' visual or kinaesthetic approaches (Morgan and Klein, 2000).

It could be suggested that traditional teaching methods for learning in HE, where large numbers of students are often taught in vast auditoriums, cannot easily be adapted to fit with this model of classroom practice. Powell and Tummons (2011) suggest that some HEIs have some support strategies in place to facilitate access to learning for learners with developmental dyslexia in lecture and seminar situations. For example, tutors may provide materials a week in advance so that the learner can read and absorb information prior to class. Although conceptually this approach reflects the 'deficit' or medical model of disability, it is useful because it enables the learner to avoid a situation where a slow reading rate may limit the amount of text that can be dealt with, leading to exhaustion of mental energy, a lack of attention and eventual disengagement with the reading task (Sabatini, Sawaki, Shore and Scarborough, 2010). The issue of reading and comprehension is documented in a number of studies of non-interventionalist design. Two studies in particular (Kirby, Silvestri, Allingham, Parrila

and La Fave (2008) and Simmons and Singleton (2000) evaluated a specific skill set relevant to reading and comprehension. The skills identified in the studies are arguably required to succeed in higher education study, they are: reading rate (speed of reading), literal comprehension ability and inferential comprehension ability. Although these studies' findings identified that students with dyslexia reported a greater history of prolonged reading difficulties, the studies actually identified that there were no notable differences between the reading and understanding of literal questions and that there was only a marginally significant difference in reading speed. This adds weight to existing research which suggests that adults with dyslexia can read and comprehend as well as their peers when reading non-complex and non-specialist texts, but that they are slower in doing so (Lee, 2002; Reid and Kirk, 2001). Therefore, additional time to read materials in sessions, or the opportunity to read texts of notes in advance, would appear to be a reasonable adjustment to support the comprehension of materials. Real issues can arise, which may be more tricky to deal with, when unfamiliar and/or more difficult text is presented to learners. The studies' outcomes suggest that when text of this is presented to learners with dyslexia, it causes additional problems with comprehension as gaining understanding of the text relies on the underlying skills and nuances of language related to gaining meaning. Although the studies suggest that there were poorer performances from both the non-dyslexic and the dyslexic learners in the tests of inferential comprehension, the dyslexic participants' performance was worse. Reading comprehension, especially with texts that are non-literal, is not a straightforward process. As Alfassi (1998) explains, complex reading tasks require an equally complex level of cognitive processing, thinking space and time. In order to learn effectively from texts, learners must be able to simultaneously concentrate on the materials and on themselves, check whether the reading is resulting in learning and also know how to handle comprehension failure. In addition to this, differing lengths of texts and more complex texts require adequate short-term or working memory capacity, as holding information in the working memory for a period of time is needed for the complex cognitive processes of understanding to take place (Gathercole, Alloway, Willis and Adams, 2006). With elaborate and unfamiliar text, the cognitive function is more complex when trying to decode (read)

and comprehend (understand) text and this requires increased capacity in the short-term memory. If this capacity is not available, the process of reading and comprehension will be disrupted, affecting reading speed, fluency and accurate recall as the working memory is overloaded (Lee, 2000). If we consider the phonological 'deficit' hypothesis, and the temporal and cerebral processing 'deficit' hypotheses, factors such as poor phonic attack (Nation and Snowling, 2004) inefficient temporal processing (Tallal, 2004), reduced lexical automaticity (Fawcett and Nicolson, 1999) or a combination of one of more of the aforementioned, it is hardly surprising that reading and understanding complex texts presents issues for adults with dyslexia. These 'deficit' hypotheses offer prosed explanations of why adults with dyslexia are, albeit marginally, slower readers but will have greater difficulty in taking meaning from text, especially if it is unfamiliar and complex. Frequent re-reading is a common observable factor in adults with dyslexia, another factor suggesting that gaining meaning from text can be problematic. The Kirby, Silvestri, Allingham, Parrila and La Fave (2008) and the Simmons and Singleton (2000) studies provide some evidence of issues in reading and understanding in adults with dyslexia when compared with peers, but how this can be ameliorated in a practical way for curricular delivery in HE is open to question. The very nature of HE means that students will frequently be placed in situations that demand a certain level of reading proficiency and that they will regularly be introduced to unfamiliar, discipline-specific language that they are required to learn.

Therefore, the provision of materials for learners with dyslexia in advance of his or her peers can provide opportunities for pre-learning. This can help to avoid placing the learner with dyslexia in a situation where short-term memory overload and processing delay can occur and can help to ameliorate the issues related to the comprehension of the text that he or she may encounter if presented with unfamiliar materials at the same time as his or her peers. There is also the related stress and anxiety that may result if the learner is placed in a situation such as this. Therefore, this method of preparation, or the opportunity to pre-learn, is often very useful to the adult learner with developmental dyslexia and helps to avoid information overload and can improve comprehension.

Handouts on coloured paper may also be provided in advance, or coloured overlays may be provided to stabilise lettering on the page when visual disturbance is present (Wilkins, 2003). This can be extremely helpful to the adult with developmental dyslexia who has a visual-processing deficit and may encounter visual stress as a result (Singleton and Trotter, 2005).

Beyond this adaptation to physical resources, there appears to be little occurring to make learning more accessible for learners with developmental dyslexia specific to the lecture and/or seminar situation (Klein and Krupska, 1995). Evidence from practice (Lee, 2002; Rice and Brooks, 2004; Smith, 1996) suggests that the synchronous use of the four modalities of verbal, auditory, visual and kinaesthetic channels, also known as multi-sensory teaching (MST) and multi-sensory learning (MSL), which are known to support access to the curriculum for learners with developmental dyslexia, is not widely practised. If it were, it could be argued that this would enable the session content to be more readily accessible to learners with developmental dyslexia. MST and MSL programmes are used by specialist centres such as Dyslexia Action (formerly the Dyslexia Institute) to promote sustained learning for those with dyslexia. These programmes have a proven track record of success in improving reading and writing skills (Dyslexia Institute, 1998; Dyslexia Organisation, 2018). These approaches to teaching and learning may not be common in HE practice for a number of reasons: a lack of staff development is one example, time to develop resources may be another. Best practice in facilitating learning for adults with developmental dyslexia tells us that tutors should be provided with training regarding how learning can be made accessible at the design stage, what the concepts of MST and MSL are, and how MST and MSL can be incorporated into all types of teaching and curriculum delivery. Finally, support and training in how to choose and use resources that can support learning for all would be beneficial (Morgan and Klein, 2000; Lee, 2002; Reid, 2017).

From the different perspective of support that is offered outside the classroom, many HEIs offer additional learning sessions to students in need of academic skills support. The vast majority of this is

general study skills support (Fry, Ketteridge and Marshall, 2009). What is not known is the extent to which this support would be appropriate to meet the needs of adult learners with developmental dyslexia. This will depend to some extent on the severity of the dyslexia and the skills of the tutor.

According to Lee (2002), an aware tutor will be able to meet the student and evaluate (via the reading of provided psychological reports, by implementation and analysis of a diagnostic assessment or by discussion with the learner) the severity of the problem and then be able to put in place an appropriate learning plan. Lee (2002) suggests that for a mildly dyslexic learner, a support package may include a multi-sensory spelling programme that will enable them to learn key words associated with the discipline. For moderate dyslexia, Lee (2002) suggests a multi-sensory spelling programme alongside the use of a structured language programme as such as Alpha to Omega (Hornsby, Shear and Pool, 2006) in order for the learner to develop reading and spelling skills in a logical and sequential way. This can be a fast-track or slower track programme according to identified need. Finally, for severely dyslexic learners, all of the above should be utilised, but the programme of structured language development should be applied in a rigid way. In addition to this, exercises and activities to increase short-term memory capacity should be used where possible (Lee, 2002; Smith, 1996). Learners with developmental dyslexia may also need support for organising note-taking, organising handouts in class, planning work to meet assignment deadlines, help with proof-reading and organising writing; this should also form part of the overall support package (Klein and Krupska, 1995; Smith, 1996).

The final facet of support for adult learners with dyslexia explored here are the roles of information communications technology (ICT) and assistive technology (AT).

2.5 Information communications technology, assistive technology and dyslexia support

In recent times, there has been a growth in the use of technology in further education (FE) and HE. It is suggested that this is due to multiple forces and influences, e.g., the mass use of electronic

information systems and legislation that mandates the use of reasonable adjustments to support access to learning for those with learning disabilities (Raskind and Higgins, 1998). More recently, the use of tablets and smart phones, etc. in classroom situations is increasingly noticeable (Chen and deNoyelles, 2013). Published research of good quality that evaluates the use of AT and ICT to support learners with developmental dyslexia in both FE and HE is minimal in volume, but several of these support mechanisms have been evaluated. These include the use of hardware such as word-processors, personal computers, laptops, tape recorders, digital/electronic reading and writing pens, and software such as proof-reading software, speech recognition software, speech synthesis with screen-reading software, and text-to-speech software. There is currently no published research specifically focusing on the use of tablets or smartphones by students with specific learning difficulties or disabilities such as developmental dyslexia.

Raskind and Higgins (1998) provide an overview of some of the research into the hardware and software and its use in particular for college and HE students with dyslexia. The use of word-processors and personal computers is commonplace in today's academic world, and laptops and tablets are used by a number of students. This hardware, when coupled with writing software that includes spelling and grammar checks as a minimum, is particularly useful for learners with specific learning difficulties such as developmental dyslexia, as they enable the learner to engage in free writing without being distracted by concerns about incorrect spellings and misuse of grammar. Spelling and grammar checks can be completed at the end of a free writing period relatively easily. To use this function effectively for the correction of spelling etc., the writer needs to be able to select the correct spelling from the range of options presented; this can be an issue for the adult learner with developmental dyslexia. Some software packages include dictionaries and thesauri that can help the learner with the correct spelling choice. Some of the basic software packages have a read-aloud function that can be used in conjunction with headphones to assist in the decoding of the words. Therefore, for learners with specific learning difficulties such as dyslexia, a word-processor, laptop or personal computer can be

very useful and remove barriers to learning. Another factor to consider is the accessibility of hardware. Laptops can be transported where personal computers and word-processors are stationery. Laptops can be useful for note-taking in lectures and seminars, but a certain level of speed and skill with the laptop is needed to gain full benefit from it, often with the use of some assistance; however, the laptop may be the better option of the three due to its transportability. For this range of hardware, and to gain the most benefit in supporting learning, the user needs to be trained in its functions, which in itself takes time. The research also suggests (Raskind and Higgins, 1998) that best use of these can be made with some additional tutor support or assistance.

Tape recorders and voice recorders can be extremely useful for learners with a specific learning difficulty such as developmental dyslexia. They enable lectures to be recorded and played back, and some of them enable audio books to be read. They provide the opportunity for over learning and repetition, which will assist the learner with developmental dyslexia to interpret content and develop understanding. They also remove the pressure or worry of having to comprehend and assimilate information at the first time of delivery, when usually there would have been only one opportunity to do so. Tape recorders that have a speed control function are the most useful as this will enable the recording to be played back at a speed that would help in avoiding short-term memory overload. Tape recorders without this function have limited use and can lead to frustration for the learner in trying to keep up (Raskind and Higgins, 1998).

The next area explored is digital reading and digital note-taking pens. Digital reading pens and digital note-taking pens are pens that provide a range of functions. There are a limited number of small-scale studies that have attempted to evaluate the use of these two types of digital pen as an intervention to support learning for learners with specific learning difficulties such as developmental dyslexia (Belson, Hartmann and Sherman, 2013; Schmitt, McCallum, Hennessey, Lovelace and Hawkins, 2012).

Digital reading pens function by passing the nib across a word. They then display the word and, if needed, the definition of the word on the digital screen. Some models have an electronic voice that reads the word/text aloud (text-to-speech function). In some models, there is a scanner function for capturing lines of text and uploading this to a personal computer (Assistive Technology for Dyslexia, 2017). They have been shown to assist learners who have dyslexia, particularly if they are a model that has a text-to-speech function as this enables the text to be heard without the learner needing to decode or apply a visual–verbal code linkage. However, there have been variable results concerning the usefulness of digital reading pens; for example, it is claimed that they are not helpful for developing comprehension, as they do not address issues with reading fluency, and without reading fluency, the ability to use context, syntax and inference to aid comprehension is limited. They are more useful for some learners with specific learning difficulties than others: this would depend upon the severity of the developmental dyslexia and the predominant processing problems (Schmitt et al., 2012). Digital note-taking pens allow handwritten notes to be digitally stored and edited (Assistive Technology for Dyslexia, 2017). The key findings of the research by Belson, Hartmann and Sherman (2013) are that these pens are useful in improving the quality of the notes students take in terms of selectivity and content. This is helpful for a dyslexic learner as the ability to differentiate between what is important and what is not important is a particular problem. They also help with the development of content knowledge and in determining and highlighting the important parts of a lecture via use of the playback and edit function again, emphasising that the learner need not be reliant on hearing the content once only. The pens with an audio playback function were also the most useful as they enabled the learners to compensate for difficulties in following along (keeping up) and in paying attention to details. Another advantage of the pens is their relative ease of use. Training in the use of both of these pens can be accomplished in 15 minutes. The use of digital note-taking pens was more useful than the digital reading pens for a greater number of learners with specific learning difficulties such as developmental dyslexia. This may be due to some active compensation in reading. However, the studies were extremely small scale.

Reading software is available that has been investigated in its use in supporting learners with specific learning difficulties such as developmental dyslexia (Raskind and Higgins, 1998). Again, the outcomes of these studies with regard to their usefulness were varied. Proof-reading software is able to identify probable errors in grammar, punctuation, word usage, spelling style or capitalisation, but is not accurate and has been shown to make incorrect suggestions to the learners using it. This is counterproductive. These packages can also have mind-mapping or 'knowledge dump' options which were viewed as more useful by the learners than the proof-reading function as they assisted with the organisation of ideas. However, overall, learners reported that they found the proof-reading aspect of this software demeaning as it led to feelings of ineffectiveness, incompetence and a loss of control over the writing. Generally, feedback on proof-reading software was not positive.

Speech synthesis with screen readers was also evaluated; these have a synthetic or computerised voice-output system combined with screen-reading software. They will read back and highlight text on a screen so that the reader can see and hear simultaneously what is displayed. These proved particularly useful for learners with oral skills superior to their written language skills, which is often the case with dyslexia. The use of these would be limited to independent study time outside the classroom. However, they have proved very beneficial when made available (Raskind and Higgins, 1998).

The final areas explored are speech recognition and text-to-speech software (Gotesman and Goldfus, 2009; Raskind and Higgins, 1998). Speech recognition software enables what is spoken to be produced in written form. This kind of software is often used with personal computers and laptops, but more recently has become available as applications in some smartphones and tablets. One of these more advanced technical software packages is Spam Limiting Tactile Reinforcement (SLTR) (Schneps, Brockmole, Heffner-Wong, Pomplun, Hwang et al., 2010). These types of applications incorporate tactile reinforcement and additional sensory input that is believed to aid in comprehension (Campbell,

Helf and Cooke, 2008). In other words, they have a read-aloud function, they may have a spell-aloud function, and they may also have a dictionary and thesaurus function which will assist with developing morphemic understanding and grapheme or letter- or word-pattern awareness (Crystal, 1997). These applications can also control the way in which electronic texts are read, such as limiting the number of words on a line, text segmentation, and limiting right peripheral views (which can cause problems with some types of dyslexia where the reading span is larger than average (Geiger and Lettvin, 1987). They in effect control the amount of text to be dealt with and also the speed with which the text is presented to the dyslexic reader to the point where it is manageable.

There is a small amount of research that suggests these methods have proven superior to conventional paper reading for those with dyslexia and that just 30 minutes of training in their use has resulted in demonstrable reading gains. Specifically, students that have used them have shown significant gains in word recognition, reading fluency, and applying, developing and maintaining new reading strategies, and have become motivated to read and participate more in class and homework tasks. These learners have also achieved better grades and been better prepared to read articles for the completion of independent tasks (Russ, Chiang and Rylance, 2001; Goldfus and Gotesman, 2010). It seems that assistive applications such as these could be encouraged for use by dyslexic students in HE settings to promote independence in their learning as well as being of some use in lecture situations in supporting reading and the comprehension of written text.

The main issue raised by students in the use of these technologies was the training of the software package to recognise the learner's voice; this is necessary to improve the accuracy of the text produced and can take up to three hours. The positive aspects, however, were that the dictation software produced between 40 and 70 words a minute, using the learner's own speech and authentic thoughts, and the text could then be checked by other personal computer word-processing functions, such as grammar and spell checking. Again, this would only be useful in an independent learning

situation outside the classroom. Feedback on the usefulness of these, once the voice training was completed, was positive. Text-to-speech software works in the opposite direction, and takes written text and speaks it 'out loud'. A small-scale study (Gotesman and Goldfus, 2009) with postsecondary students with specific learning disabilities identified that the use of text-to-speech software provided benefits in a number of areas. The software assisted with the comprehension and decoding of written text, and as a result word recognition and reading fluency both improved, and the software helped the learners to learn, apply, develop, maintain and generalise new reading strategies. The software motivated learners to engage in reading and appeared to support greater confidence and increased participation in class-based and homework tasks. Learners also achieved better grades and were more able to read articles in their individual fields of study. This appears to be very positive, but any direct outcome claims for the intervention (of text-to-speech software) are called into question as the use of the software was combined with other teaching and learning activities, i.e., differentiated instruction and frontal teaching. Therefore, it is not clear which aspect predominantly benefited the learners. However, improvement in the reading skills among those accessing these support interventions was significant. This also highlights the role of appropriate additional tutor input and support to enable the most benefit to be gained from non-human types of interventions.

In summary, it is suggested that some forms of AT and ICT, in a range of guises, can be useful to support access to learning for learners with specific learning difficulties such as developmental dyslexia, but that the emphasis should be for assistive rather than remedial or instructional use. The technology is most beneficial for learners with reading disabilities when utilised alongside human assistance to support learning. It is also clear that some of the technologies may be detrimental to learning if they do not fit the skills base of preferred learning approaches of the learners and that it is very much down to personal preference and needs (Higgins and Zvi, 1995).

2.6 Conclusions

This chapter demonstrates that developmental dyslexia is a complex condition that can show itself in a number of ways. It can be viewed from a 'deficit' model of disability or a social model of disability (Powell and Tummons, 2011).

As a 'deficit' or medical 'disorder', it can be seen to have negative connotations. Critiques of the medical model suggest that it merely gives doctors and medics control over the treatment of individuals with disability in society. It enables them to apply labels as a way to position themselves as gatekeepers for society and use these labels to determine whether individuals receive resources and define a person's individual needs and how they receive assistance for those needs based on their 'impairment'. Finally, they may not take into consideration the actual desires of the individual (Haegele, and Hodge, 2012). The dyslexic condition itself is described as being of unspecified biological origin, affecting a range of functional processes and manifesting at the behavioural level with a variety of observable characteristics. These are seen as issues with reading, writing, working memory (or short-term memory), laterality, temporal processing, motor processing and organisational skills. Developmental dyslexia, therefore, is resistant to learning when the usual teaching and learning techniques are employed (Hornsby, 1996). It does respond to instructional teaching approaches that are delivered in a way that supports multi-modal learning. The most successful of these utilise multi-sensory approaches and therefore focus upon the simultaneous use of the four learning modalities of hearing, saying, feeling and seeing.

From the perspective of the social model of disability, which itself separates disability from 'impairment' and treats them as two separate entities (i.e. the 'impairment' is the 'abnormality' of some part of the body or mind, and disability itself is considered as the disadvantage or restriction of activities caused by a social organisation that does not take into account people who have impairments and so excludes them from community life) developmental dyslexia can be viewed as a

learning style or a specific learning preference that responds well to teaching and learning approaches that rely less on verbal language-based learning and more on holistic, pattern-seeking, visual, tactile learning.

The limited amount of research available that focuses upon the use of AT and ICT to support adults with developmental dyslexia in HE has mixed outcomes. The success of this depends to some extent on the skills base and motivations of the learner. Overall, the existing research suggests that, to enable the adult with developmental dyslexia in FE or HE to achieve their full potential, some adaptations to the 'normal' teaching and learning approaches are desirable.

The type, scope and usefulness of the support provided to learners with dyslexia is something the cross-sectional website survey and documentary analysis (study 1) alongside the systematic literature review (study 2) may help to establish. It may also bring to light any tensions between institutional level 'promotion' and 'championing' of the social model of disability for its learners, in contrast to the practices of academic tutors/lecturing staff, which existing research tells us, as discussed earlier in this chapter, may be more reflective of the 'deficit' or medical model.

The next chapter of this thesis is study 1. It contains the results of a cross sectional survey taken from a sample of HEI websites and a documentary analysis of the website content. The purpose of this is to investigate the promoted offer of support for students with dyslexia on programmes of HE in England to: identify the key components of the support offer, to identify any patterns or models of existing good practice and to highlight any areas of practice which may need enhancement. This is reflective of the first aim of the research.

Chapter 3 Website Survey and Documentary Analysis

3.1 Aim, background and rationale

This chapter describes the cross-sectional website survey and documentary analysis of the reported support mechanisms for students with dyslexia in place in a range of HEIs. It addresses the research question: *'What support mechanisms are in place for adults with dyslexia in higher education institutions?'* This work is complementary to, but independent of, the systematic review (Chapter 4).

3.2 Design and Method

The aim of this aspect of the research was to identify, gather and describe the activities in place to support learners with dyslexia on programmes of higher education from a representative sample of HEIs in England. The objectives of the research were to: i) identify of a sample of websites for data collection and ii) collect, analyse and consider the implications of the data for current policy and practice.

The research required a design that would enable the collection of descriptive, textual data over a limited period of time. Therefore, the use of a cross-sectional survey (de Vaus, 1985; Vignoles, 2012) and a documentary analysis of the website data (text) (Bowen, 2008, 2009) was the selected approach. The cross-sectional survey design was suitable for a number of reasons: it facilitated the collection of data at a single point in time (Mann, 2003; de Vaus, 1985 p.40) in order for a snapshot of the activities within the HEIs to be gained; it did not involve manipulating variables, its intent was observational; it allowed for multiple characteristics of the sample population to be examined and it can often the way for future research (Farmer, Miller and Lawrenson, 1996). The cross-sectional survey design was an appropriate way of gathering the data (or evidence) to meet the first objective of the research, and therefore warranted the approach taken (Gorard, 2002).

The textual data collected from the HEIs included in the cross-sectional survey sample was analysed using thematic documentary analysis (Bowen, 2008, 2009). The process of thematic analysis enabled the data to be organised into emerging themes and for a discussion of the services available to support learners with dyslexia within the sample HEI institutions, at the point in time that the data was collected, to take place. The documentary analysis design enabled the required type of descriptive evidence to be collected that was able to answer the second objective of the research, thus adding warranty to the approach taken (Gorard, 2002).

The cross-sectional survey and documentary analysis should be viewed as a scoping exercise used to establish how the support services within a sample HEIs are advertised, accessed and potentially implemented, it was not intended to give a full picture of activity across the sector; its intent was to gain a 'feel' of the types and patterns of available support, having said this the sampling strategy (see below) enabled all types HEIs in England, across a number of regional areas, to be represented.

3.3 Sampling strategy and process

A combined strategy of stratified, cluster and random sampling (de Vaus, 1985; Farmer, Miller and Lawrenson, 1996) techniques were used (in sequential order) to ensure that the final sample of HEIs in the cross-sectional survey data collection (and subsequent documentary analysis) were proportionately represented (de Vaus, 1985). Therefore, all types of HE institutions in England across as broader geographical area as possible were included. The first stage of the sampling process was to gather information about the target population in order for the process of sampling to take place; thus, an initial scoping exercise (was carried out to establish the number of universities in England, their types and when they were formed. This information is presented in Table 1.

Table 1: Higher education institutions, showing type, formation date and number

Type	Formation date	Number of institutions in England
Ancient universities	founded 1167–1209	2
18th- and 19th-century universities	founded 1832–1836	2
The London Federation of Universities	founded 1836–1971	13
Civic universities (including those known as 'red-brick universities')	founded 1900–1957	Red brick 6 Non-red brick 6
Plate-glass universities	founded 1961–1969	23
Intermediate era universities	founded 1969–1984	2
New universities	founded 1992–2013	61

Source: A History of the World, 2015.

This exercise established that there are 111 HEIs in England which are categorised as seven different types (About History, 2015; A History of the World, 2015). For the purpose of the sample, the population was stratified into two representative sub-groups: pre-1992 universities (50 institutions) and post-1992 universities (61 institutions). This sub-grouping of universities into two groups was founded upon the most unambiguous defining factor between them (de Vaus, 1985), i.e. it is a fact that some institutions were formed before the Further and Higher Education Act 1992, and some were formed post Act. It is necessary for a difference, or a division point (or a defining variable, Farmer, Miller and Lawrenson, (1996)), to be established before the first step of stratification can take place. This was also useful, as separating the HEIs at this point enabled the opportunity to collate evidence from each sub-group for comparative analysis between the 'old' and 'new' institutions to be

undertaken from what some consider to be two distinct 'institution types' and 'student populations'. The creation of the sub-groups also provided a broad frame of reference to work within when reporting and discussing the findings (de Vaus, 1985). Following this, both sub-groups were separately divided into geographical regional clusters. This ensured that the final sample would contain representation of all types of institutions across as wide a geographical area as possible.   The final stage of sample selection was to determine the size of the sample to be taken from each of the sub groups, and to ensure each cluster was represented in the final sample. It was also important that the final sample provided enough evidence to answer the research question, but that the data was of manageable proportions (de Vaus, 1985; Vignoles, 2012). Given this, 11 HEIs was the sample size settled upon. As the number of new universities was higher, six of these types of institutions were selected randomly across their sub-group clusters and five pre-1992 universities were also selected randomly across their sub-group clusters. This gave a ratio of 6:5 new to old HEIs for inclusion in the survey. This provided a 10% sample size (a sizable proportion of the study population according to Moser and Kalton, 1971 (de Vaus, 1985, p. 72) and as it was a sizable proportion it was able to provide defensibly accurate data. The final sample population in represented in Table 2.

Table 2: Sample of higher education institutions included in the cross-sectional survey, showing type and regional area

Higher education institution	Type	Location
HEI1	Pre-1992 (ancient)	South
HEI2	Pre-1992 (18th/19th century)	North East
HEI3	Pre-1992 (London Federation)	South East
HEI4	Pre-1992 (civic, red brick)	North West
HEI5	Pre-1992 (plate glass)	Midlands
HEI6	Post-1992 (new)	South
HEI7	Post-1992 (new)	Midlands
HEI8	Post-1992 (new)	South
HEI9	Post-1992 (new)	Midlands
HEI10	Post-1992 (new)	North East
HEI11	Post-1992 (new)	North West

3.4 Data collection and data extraction

The website surveys were completed over a two-week period in November 2014 with the first institution (HEI1) being utilised as a pilot which enabled the development of a transparent and replicable approach to data collection and support a coherent, linked and logical analysis of the data findings to occur (Anfara, Brown and Mangione, 2002; Gorard, 2002). The HEIs were anonymised as

the inclusion of the names would not have added any additional depth to the data or added value to the study. Also, not anonymising the HEIs could have led to reader preconceptions (or bias) about a particular institution, thus acting as a barrier to objectivity (Clark, 2006).

A data searching and collection template (Appendix A) was developed to enable the data to be collected methodically, sequentially and systematically assisting with the trustworthiness of the data collected (Nowell, Norris, White and Moules, 2017). The data searching and collection template was designed to capture all areas of interest relevant to the research aim and question that needed to be located for potential inclusion in the data extraction process. Examples of this are: support information for applicants and current students; the role of any central institutional disability services; and access to dyslexia screening and assessment. The data searching and collection template worked effectively in structuring and focusing the website searches and for holding the information from each one. This template's use was replicated for each subsequent search, ensuring that the information located in each website was achieved using a standardised approach. It was used primarily as an organisational aid to enable the collection of electronic links (structured through a number of the website pages) to be held in one place in order to establish an overview of the information and to relocate it at a later date if needed. The next stage was to use the links within the data searching and collection template to explore the web text that was behind each of the electronic links. At this point, in order to ensure that valuable data was not missed, all the pages and subpages of the website were printed and stored manually for later analysis.

3.5. Data coding

The website text from each institution was coded using a two-step process. Firstly, the coding of both the relevant and irrelevant data from each of the HEI website's text was completed. To assist with this, six criteria were developed reflective of types of information, under broad themes, that had been located by the website searches and which were held in the data searching and collection template. For the first level of data sorting, website text that met one or more of the criteria, was tagged 'yes'

and remained in scope. Text that did not include information relevant to any of the criteria was tagged 'no' and removed from the survey.

The next stage of the process was the coding and organisation of the remaining units of data (or text) under their relevant criterion to identify any content within this data that was particularly pertinent to the research aim and question. This was achieved by the development of a set of questions related to each criterion which were used as a prompt, or a checking mechanism, during the process of data coding for each institution in the survey to ensure that no relevant data was missed and to add standardisation to the coding process. A combined sequential numerical and alphabetic coding system (Fereday and Muir-Cochrane, 2006) was applied to each website's text to ensure that it was appropriately tagged. For example, information relating to the assessment criterion and the psychological assessment question would be coded as 1c, examination support and amanuensis would be labelled as 5a and so on. The criteria and their associated questions are located in Table 3.

Table 3: Criteria and questions used for data identification, sorting and coding

Criterion 1. Assessment	Criterion 2. In-class adaptations/supportupport	Criterion 3. Additional learning support (including mentoring and coaching)	Criterion 4. Assistive technology and ICT	Criterion 5. Examination support	Criterion 6. General disability support
a. Does the institution offer a full assessment of academic needs?	a. Does the institution adapt curriculum delivery in lectures/seminars to meet a range of learning needs?	a. Does the institution offer generic study skills support?	a. Does the institution provide basic assist tools such as adaptable keyboards, PCs, laptops and digital voice recorders?	a. Does the institution have mechanisms for providing exam support such as extra time, amanuensis, reader, assistive technology etc.?	a. Does the institution have downloadable study skills support packages?
b. Does the institution offer dyslexia screening?	b. Does the institution offer note-takers/opportunities for voice recording in lectures/seminars?	b. Does the institution offer targeted/specialist tuition/support for those with SpLDs/dyslexia?	b. Does the institution provide access to a range of more specialist software for SpLDs, such as voice recognition software (e.g. speech to text).		b. Does the institution have an enhanced library services?
c. Does the institution offer full psychological assessments for learners with dyslexia by a specialist tutor or educational psychologist?	c. Does the institution provide learning materials in accessible formats to meet individual needs, including those with dyslexia	c. Does the institution offer specialist tuition specific to the dyslexic learning style and/or or to compensate for 'deficits' that may be seen in a dyslexic learner profile?			c. Does the institution provide general on campus support and help?
		d. Does the institution offer generic mentoring and coaching support?			
		e. Does the institution offer specialist coaching and mentoring for those with SpLDs , including dyslexia?			

3.6 Data extraction

The next stage of the process was to extract the coded data from the printed website information on an institution-by-institution basis. In order to do this, a data extraction template was developed (Appendix B) which enabled the coded data to be extracted and stored in an organised manner. The data extraction template enabled data to be organised in two ways. Firstly, it enabled the data to be categorised according to its target audience. This allowed for differentiation to be made between generic learning support (support for all learning-disabled students, including those with dyslexia) and specialist dyslexia support (specially designed additional tuition for learners with dyslexia alone) in the sample institutions. Secondly, it allowed the data to be categorised according to the type of support available, for example, dyslexia screening and assessment, in-class adaptations to improve accessibility to learning, mentoring, ICT or AT available, examination support offered and so on. The completed data extraction templates for each institution provided a comprehensive summary of the support offered within that institution and formed the basis of a critical discussion for each one. These can be found at Appendix E.

3.7 Data analysis

The data was brought together to enable patterns and/or emerging themes (Vaismoradi, Turunen and Bondas, 2013) across the content to be established and discussed. The organisation of the textual data into these themes enabled a logical and systematic discussion of each emerging area to be undertaken and for observations and conclusions to be drawn.

3.8 Results and discussion

Table 4 provides a summary overview of additional support for each HEI in the sample, taken from the data contained in the completed individual HEI data extraction templates. An additional summary table, which groups the HEIs according to the patterns and incidence of support they offer, can be found at Appendix D.

Table 4: Available support summary: data taken from the sample 11 HEI websites

	Criterion 1. Assessment	Criterion 2. In-class adaptations/support	Criterion 3. Additional learning support (including mentoring and coaching)	Criterion 4. AT and ICT	Criterion 5. Examination support	Criterion 6. General disability support
HEI1	Needs assessment available for ICT and AT	Note-takers Lectures may be recorded	Range of 'generic' and 'specialist' additional learning support systems available	Is available – e.g. voice-activated dictation software, recording devices	Available	Central Disability Service
HEI2	Dyslexia screening	No Information available	No information available	Specialist equipment assistive technology recognition software	Dyslexia screening	No information available
HEI3	Needs assessment Full psychological assessment for dyslexia	Note-taking Reading Signers Interpreters Handouts on coloured paper	Note-taking One-to-one specialist support for those with a specific learning difficulty Specialist group sessions skills tuition Individual learning plans Mentoring	Equipment Digital voice recorders Specialist software	Amanuensis Reader Extra time	Central Disability Service

			Exemplar 'a year in the life of' and other planning/organisational resources			
			Examination techniques			
HEI4	Study needs assessment	Curriculum will be made accessible	Individual learning plan	Dictaphones	No information available	Disability Advice Team
	Full psychological assessment	Handouts on coloured paper	Mentoring	Specialist software		
	Disabled student checklist		'Generic' and 'specialist' study skills support			
			Large-print books and journals			

HEI5	Screening service may advise a full dyslexia assessment	'Reasonable adjustments' can be made	No information	Scanners	Available	Disability Adviser
				Text-speak Braille printers	'Reasonable adjustments'	
				Bookable units/spaces available		
HEI6	General study skills assessment	Communication support	Specialist one-to-one dyslexia tuition	Equipment loan facility	Available	Disability Support Service
		Note-taking	Small-group workshops			
HEI7	General learner self-assessment questionnaire	No information available	One-to-one study skills support	Specialist equipment and software	Extra time	Study support advice and signposting service

			Access to a specialist study skills tutor	Digital voice recorders		
HEI8	Dyslexia screening	Note-takers	Study skills support Peer support scheme	Extensive facilities Specialist software Assistive technology	Available	Student Services Centre Disability Support Officer
HEI9	Dyslexia short assessment Dyslexia screening Full psychological assessment	Copies of lecture notes and handouts provided a week before the session	General study skills support	Text-to-speech software Magnification software Digital voice recorders	Amanuensis Reader Rest breaks Additional time Smaller exam venue Adjustable chair Alternative assessment format Personal computer	Central Disability Service

HEI10	Dyslexia screening Full psychological assessment	Adjustments to teaching methods and materials can be made Copies of presentations/overheads in advance Online lecture notes before the lecture Sensitive feedback on written work note-takers in lectures	Sensitive feedback on written work Study coaches One-to-one and group study skills sessions	Digital voice recorders Assistive software e.g. voice recognition software equipment	Extra time Note-taker/scribe Reader Other 'adjustments'	Central Disability Service
HEI11	General needs assessment Full psychological assessment can be obtained but not offered on campus	Extra time to complete activities	Specialist support provided by a dyslexia specialist	Computers Specialist software Digital voice recorders	Extra time	Dyslexia Support Team

During the process of data analysis, it became apparent that much of the information established from the HEI websites was demonstrating repeated patterns of information under similar themes and that on reaching the analysis of data for the final three institutions, no additional findings were coming to light. Bowen (2008) advises that there is little validity in pursuing more data at this point as new information is unlikely to be established (data saturation has been reached). This suggests a sound evidence base had been established for valid observations and reflections to be made.

3.8.1 Discussion: consistency of support across institutions

Seven of the 11 institutions offered a general screening of learning needs for all learners. Seven offered a dyslexia screening service and eight offered full psychological assessments. Only HEI1, HEI10 and HEI11 appeared to offer all three. Therefore, according to the website data, the remaining eight institutions can be considered to have a less systematic approach in identifying general study needs for all learners and additional needs for learners who believe they have a specific learning difficulty, including dyslexia.

The most consistent support for learners across the highest number of categories and the 17 questions (within these categories) was found to be at HEI1, HEI11 and HEI5. These institutions offered a range of support opportunities that focused on the assessment of needs and the development of general study skills, as well as providing opportunities for access to specialist tuition. This sample included two pre-1992 institutions and one post-1992 institution.

Those in the middle rankings for consistency were HEI11, HEI4, HEI9 and HEI3. These institutions offered a package of additional learning support from assessment through to generic study skills help, but information about access to specialist tuition for learners with dyslexia was missing or not detailed. In some instances, the institutions claimed to offer specialist tuition but this was not evidenced through the available data. This sample included two pre-1992 institutions and two post-

1992 institutions. Those in the lowest rankings in terms of consistency of the support packages on offer were HEI2, HEI6, HEI7 and HEI8. This sample included one pre-1992 institution and three post-1992 institutions.

Analysis of this information would suggest that that, using proportional representation, the pre-1992 universities appear to provide a more rounded support package than the modern universities for their students with a diagnosis of dyslexia.

3.8.2 Discussion: adaptations to curricular delivery

All the institutions in the survey offered access to a range of in-class support opportunities.

Research tells us that this traditional method of delivering material is not the most effective in providing access to information (and learning) for those with dyslexia; however, some institutions made reference to efforts made to make the lecture delivery method more accessible. Five out of the 11 institutions stated that note-takers were available if the appropriate evidence of assessment needs was in place (HEI1, HEI10, HEI2, HEI4, HEI5). One of the 11 institutions indicated that they would adapt the curriculum to make it accessible (HEI11) but did not give any examples of how this might happen, and an additional three of the 11 institutions indicated they would make 'reasonable adjustments' (HEI5, HEI8, HEI9). Examples of this are providing class handouts a week early, allowing the recording of lectures and providing extra time to complete tasks. The extent to which any of these strategies can promote increased learning in the lecture room is debatable, especially given the lack of detail evident in the website information where it is claimed the curriculum is adapted. The exception to this could be the prior provision of handouts, which may give the learner with dyslexia the additional time required to process and comprehend the textual information. Given that the learner with dyslexia will often have to allocate attentive resources to the task of decoding (unlike fluent readers, who do not; Fuchs, Fuchs and Hosp, 2001), this approach could be an effective one. Provision of handouts prior to

lecture and seminar sessions may also provide opportunity for the learner to work with a tutor or support assistant to gain understanding of the information contained in it and may make the subsequent lecture itself more accessible to the learner.

It may be more challenging to adapt lecture sessions, given the logistics of developing multi-sensory approaches to teaching and learning, but for seminar sessions, workshops, small-group and paired tasks, which are traditionally smaller, a different argument could possibly be applied. Additional consideration could perhaps be made regarding the way practitioners respond to the different needs of individuals requiring support. Consequently, the adaptation of teaching and learning methods used and the materials provided to enhance opportunities for learning for those with dyslexia in these more manageable learning situations could be an option. It cannot be suggested, based on this evidence, that tutors in seminar situations are utilising a range of media for the delivery of the session content, and this in itself raises further areas for consideration, such as the implications for staff development and training if tutors are expected to adopt specialist teaching strategies and to adapt their materials for their lessons. Then there are the implications for the expectations this may raise in the students themselves as to what is acceptable as a reasonable adjustment in order to facilitate more inclusive access to the curriculum.

3.8.3 Discussion: additional learning support

The additional learning support (ALS) model can be defined in many ways. One of the most traditional in FE/HE settings is that ALS is 'extra curricular' or added to the normal or expected class contact time associated with a programme of study (Enquire, 2014). A common example of this would be additional literacy, numeracy or general study skills sessions that are scheduled around the set lecture and seminar times to support the development of skills/knowledge that are intended to assist in supporting and improving the student's access to learning. This model is often the preferred model of supporting learning rather than the modification of in-class delivery methods and the additional

materials that may be associated with this, which can be a complex and resource-intensive process (Powell and Tummons, 2011). It is perhaps not surprising that the additional support model (defined in these terms) is the most common model adopted by the institutions, given the ongoing traditional delivery methods in lecture theatres previously discussed (Fry, Ketteridge and Marshall, 2009).

With regard to specialist tuition, six of the 11 institutions indicated they provided a level of 'specialist' tuition for those with identified specific learning difficulties, including dyslexia (HEI10, HEI2, HEI4, HEI9, HEI3 and HEI6). Specialist tuition can be defined as support that is delivered in such a way as to meet the needs of an adult learner with dyslexia; one would assume this would mean access to multi-sensory learning, interactive resources and structured language reading and spelling programmes. However, the information in some of the website text was not detailed enough to draw any clear conclusions as to what the 'specialist tuition' comprised. Whilst phraseology such as 'specialist tuition is available' is used, no further information was available. For those that did provide more detail, examples of some of the range of support services on offer included 'one-to-one dyslexia tuition' and small study skills workshops for those with a 'specific learning difference', the development of coping strategies, dealing with anxiety, developing organisational skills, and time management, a very important aspect of a dyslexic learner's life (Lee, 2002). The exception to this was HEI10, which made specific reference to offering the above services but in addition attempted (via their specialist study skills package) to develop the types of learning skills that could be transferred into the lecture/seminar situation and therefore may improve access to learning. For example, the teaching of multi-sensory approaches to learning subject-specific spellings and activities to help increase short-term memory capacity, which may assist with the speed of processing and absorption of materials in the lecture and seminar (Krupska and Klein, 1995; Lee, 2002), were part of this institution's advertised package.

The development of proof-reading and exam preparation skills is evident across the sample. There is less focus on developing reading skills. This is unsurprising, given that by adulthood most learners with

dyslexia have mastered the skill of reading: it is the speed of reading, processing and comprehending information (Fawcett and Nicolson, 1999) and dealing with new/specialist technical vocabulary (Sabatini, 2002) where lingering issues occur. It can be concluded from this information that the students accessing these HEIs are skilled in the technicality of reading and comprehension to a degree that enables them to access information from text, even though it may take them longer to do so and so may not require additional input or support in this area of skill. Five of the institutions in the survey did not appear to provide any specialist dyslexia tuition, but all offered study skills packages of varying degrees.

All 11 institutions indicated that they had a range of information technology and equipment on loan for learners with learning difficulties and/or disabilities, for example, laptop computers and digital voice recorders. Three HEIs (HEI5, HEI3 and HEI7) provided specific examples relevant to learners with reading and writing issues. This included resources such as speech-to-text software and interactive thesaurus/dictionary software. These could be categorised as additional support mechanisms that may promote accessibility to learning both inside and outside the classroom for adult learners with dyslexia. Some research indicates that students with dyslexia using assistive software of this nature gain great benefits, especially readers with poor comprehension and limited ability to sustain concentration (Higgins and Zvi, 1995). However, the extent to which this can be evaluated as good practice across the sample of institutions is limited due to the levels of information available.

Four out of the 11 institutions (HEI1, HEI10, HEI4 and HEI5) offered general mentoring and/or coaching to learners. Just one institution (HEI1) offered a mentor and/or coach who was a specialist in dyslexia support. This is a very small percentage offering mentoring services in relation to the number of institutions surveyed. The role of the mentor/coach can be extremely helpful to all students, and not just those with a learning difficulty. All learners can be assisted by the differing directive and non-directive roles that mentors often undertake, which can typically be considered to be beyond the

scope and responsibility of the academic tutor/lecturer. These involve activities such as counselling or caretaking (Wallace and Gravells, 2005).

For adult learners with dyslexia, mentors can form a vital supporting role from both an academic and pastoral care perspective. For example, an adult with dyslexia may have low self-esteem and high anxiety (Lee, 2002; Powell and Tummons, 2011), and the mentor, in a non-directive counselling role, could listen, ask questions from time to time to help the student clarify things for himself/herself and provide a friendly ear and reassurance. Some adults with dyslexia have temporal processing, laterality and spatial awareness issues (Critchley, 1978; Fawcett and Nicolson, 2001; Rutter and Yule, 1973; Stanovich, 1988; Tallal, 1976; Vellutino, 1979; Wolf and Bowers, 1999), and therefore the mentor could also help in the caretaker role, for example, with advice on time management, planning work to meet deadlines and assisting the learner in finding his/her way around the buildings. The mentor can also play a vital role as facilitator, for example passing on email contacts, conference details and so on and ensuring that the learners are reminded of key events since adults with dyslexia can often need help with general organisation skills (Lee, 2002). Finally, the mentor in the coaching role could facilitate learning both in classroom situations and by providing some direction for future study afterwards. The mentor with generic training could be useful to a learner with dyslexia, but one with training about the nature of dyslexia could prove invaluable. What is significant is that only four out of 11 institutions appear to offer this type of mentoring service, and this could be the pivotal role that would help to make the learning experience a truly inclusive one for adult learners with dyslexia.

3.8.4 Discussion: levels of general support

In legal terms, the requirements of the Equality Act 2010 mean that learners are entitled to expect 'reasonable adjustments' to be made to enable them to access learning (HM Government, 2010). The data from all 11 institutions demonstrated that the support services offered are compliant with the requirements of the Equality Act 2010. All provided a level of examinations support, though some of

the website information at some institutions was more detailed than others, e.g. extra time, a separate exam room, an amanuensis. All institutions stipulated that a full assessment report with recommendations must be provided before these adjustments could be made.

Two of the institutions (HEI5 and HEI3) had downloadable study support packs, which may prove useful to learners with general study skills needs, although the format of these (text) documents would not necessarily be useful to learners with dyslexia who rely greatly on interactive and repeated learning. It becomes even more accessible for adult learners with dyslexia if it is presented in a format compatible with multi-modal information processing (visual, auditory, tactile and verbal) (Lee, 2002).

All 11 institutions have a central disability service. Two (HEI9 and HEI8) have 'dedicated' support in their libraries for learners with dyslexia, but provide no details of this, so the nature of this dedicated support could not be established by the website text alone.

3.9 Findings

In summary, the website survey and documentary analysis of the sample of website text suggest that:

i. **There are significant differences in the types and consistency of support promoted to adults with a diagnosis of dyslexia that is deemed to be 'specialist' and 'generic' available across the sample institutions.** Some institutions had more detail about the types of examinations support they offered, but provided less information about study skills support. Some claimed to offer study skills support packages tailored for specific learning difficulties, but did not appear to offer a thorough analysis of learning needs or dyslexia screening. This is further complicated because some institutions claim to be offering dyslexia-specific support but, on analysis, this in fact appears to be general study skills support delivered via traditional teaching techniques rather than any specialist

approaches or methods such as multi-sensory delivery (Lee, 2002) that might better assist access to learning for a student with dyslexia.

ii. **The preferred model of providing additional support for learning is one that happens outside formal lecture and seminar time.** There are few attempts to adapt the curriculum or the learning and teaching strategies used in the lecture and seminar situation to increase accessibility to the curriculum for adult learners with dyslexia. The 'bolt-on' additional learning support (ALS) model is by far the most utilised option.

iii. **Mentoring was seen to provide great benefits for students with dyslexia**. However, fewer than half of the institutions surveyed offered this service.

iv. **There is a level of generic support available across all institutions that appears to meet the requirements of the Equality Act 2010 (and its predecessors, the Disability Discrimination Act (DDA) 1995 and Special Educational Needs and Disabilities Act (SENDA) Act 1993).** However, these could be interpreted as an exercise in meeting legislative requirements for students with a diagnosis of dyslexia rather than an active and genuine approach to developing individualised support packages.

3.10 Conclusions and recommendations

Within the institutions surveyed, there are differing levels and types of support promoted to adult learners with dyslexia. What is clear is that the additional learning support model is the one that the majority of institutions prefer. References to adapting methods of lecture/seminar delivery are few. Fewer than half the institutions surveyed provided a mentoring service (provided by staff or other students), and only one of these indicated that dyslexia-trained mentors were available. Given the evidence of the positive impact of mentoring and coaching on learners and the student learning experience, this is perhaps the most surprising of all the findings.

This could be the key to facilitating a situation where a truly accessible learning experience for all learners, including those with a diagnosis of dyslexia, can happen. In order to provide a continually improving support service for adults with dyslexia, the following recommendations could be considered: a review of the website information to ensure it provides an adequately detailed picture of the in-class and additional learning support available at the institution;

- a review of the initial screening and diagnostic service promoted and offered to learners with suspected dyslexia to ensure fitness for purpose;
- consideration of some of the more practical adaptations highlighted in the discussion that can be made to the delivery methods utilised in lecture and seminars, such as the delivery of material in a way that utilises a range of learning modalities: this can be of benefit to all learners and not just those with a diagnosis of dyslexia;
- a review of the ICT and AT that are currently available to learners with dyslexia, with a view to addressing gaps in order to bring these in line with the currently available technology; and
- consideration of the development of a mentoring scheme and a network of appropriately trained mentors who will then be aware of how best to support those learners with dyslexia.

Some or all of these actions may lead to a more positive, supported learning experience for those with dyslexia, lowering attrition rates and raising student satisfaction levels.

Finally, it is worth mentioning that there are other factors outside the potential for dyslexia support offered by HEIs that may influence a student's choice of university, such as its geographical location or its curriculum; alternatively, it may be that a student avoids applying to universities such as ancient universities, which may be perceived as 'too academic' or unattainable. Students' selection of a university to read at is a complex process that takes into account many variables. This website survey and documentary analysis sought to explore just one aspect of these.

The cross-sectional survey and documentary analysis was accepted for publication by the Journal of Further and Higher Education in April 2018 and published in July 2018. Full citation details and a copy of the article are located in Appendix F.

The themes of inclusion and support identified as a result of the completion of this website survey and documentary analysis formed the conceptual and theoretical framework for the planning and execution of study 2. These themes are: support consistency and availability across institutions, the reported adaptations to curricula delivery and the reported models of additional support in use. These themes are also reflected in the theoretical discussions in chapter two; which considered aspects of dyslexia from a range of views and standpoints; for example, dyslexia as a specific learning difficulty as viewed from both the social and medical models of disability, the links between this and how dyslexia is 'defined' and the discussion of teaching learning approaches in current literature designed to promote access to learning. The discussions in, and the conclusions of, chapters two and three contributed heavily to the formulation of the aim and focus for study 2 which sets out to answer the second research question as identified in chapter 1.

Chapter 4 (which is study 2) is a systematic literature review which set out to find and evaluate any reported interventional learning support practice for students with dyslexia on programmes of education in UK higher education settings and their international equivalents.

Chapter 4 The Systematic Review

4.1 Aim, background and rationale

This chapter is the systematic review and is the second piece of independent research. It follows on from and is complementary to the cross-sectional website survey and documentary analysis (Chapter 3). This aspect of the research was completed to meet the second aim of the research, which was to evaluate the effectiveness of any interventions in place to support the learning of adults with dyslexia on programmes of HE. In order to accomplish this the following question was developed:

> 'How effective are the reported interventions that are adopted to promote the learning of adults with dyslexia studying programmes of higher education?'

4.2 Design and methods

A systematic literature review (or systematic review, Torgerson, Hall and Light (2012)) was selected as the most appropriate design to enable the location, synthesis and critical evaluation of all the existing secondary research that was able to answer the research question. As the question to be answered sought evidence of causal outputs, or the effect/s of an intervention or interventions, it was imperative that all studies of experimental design were captured for potential inclusion in the evidence base for the review. It was also essential that they were in the relevant topic area; which in this case was the effectiveness of dyslexia support for learners on programmes of higher education.

The systematic review design provided a framework for appropriate evidence to be collected that was able to answer the research question in as unambiguous way as possible using an approach that minimised bias (Chalmers, Hedges and Cooper, 2002; Cochrane, 2017; Garg, Hackam and Tonelli, 2008 and Mulrow, 1994). In addition to this, as part of the systematic review methodology, the rigorous quality checks and the 'weighing up' of the outcome claims made against the clear-cut evidence contained in the included studies helped to guard against overstatement or overemphasis

of the findings and consequently, the systematic review data synthesis and findings. This added

warranty to the claims made in the systematic review findings, as not only was there a clear

evidential link from the data collected and the conclusions drawn, any issues with the quality of the

evidential base were made transparent (Gorard, 2002).

A significant part of the systematic review design was the development of the framework or

protocol (Appendix G) which governed the planning and implementation of the entire systematic

review. The protocol is discussed more closely in section 4.2.2, but briefly the protocol includes the

systematic review research aims; its potential uses; its dissemination; its purpose; its intentions; the

searching and data collection plans and the constraints of location, time, money and resources. For

this systematic review, some aspects of the process were carefully controlled and time bound (e.g.

the searching, retrieval and screening processes (see 4.2.3 and 4.2.4) but other aspects, such as the

data extraction and quality appraisal processes took a longer period of time. The systematic review

was led by one reviewer and quality assured, in all aspects, by a second reviewer (CT). This provided

a way of standardising the decisions made throughout the review in, for example, the content of the

data extraction sheets and the quality appraisal of internal and external validity of the included

studies. This entire overarching process is fundamental to the design and implementation of any

good quality systematic review (Cooper, Hedges and Valentine, 2008; Torgerson, 2003). The whole

systematic review process was governed by use of The Preferred Reporting Items for Systematic

Reviews and Meta-analysis (PRISMA) statement and flow chart (PRISMA, 2009) (see Appendix O). In

addition to this the Campbell collaboration policy briefs (2017) and the Cochrane Handbook (2008)

were referred to as appropriate.

The PRISMA guidelines (PRISMA, 2009) in particular were adapted for the planning and conduct of the systematic review to improve its transparency, replicability (Moher, Cool, Eastwood, Olkin, Rennie et al., 1999; Shea, Dube and Moher, 2001; Petticrew and Roberts, 2006) and authority. The PRISMA (2009) guidance was applied to the conduct of the systematic review as follows: 1. The development of a research question; 2. The development of a protocol (which includes an a priori statement of the design and methods of each stage of the review); 3. Information retrieval and study selection; 4. Coding and data extraction; 5. Quality appraisal of included studies; 6. Data synthesis; and 7. The writing up of the review.

4.2.1 The research question and initial scoping

The research question for the systematic review was developed using the Participants, Interventions, Comparison (or control) Outcomes and Study Design (PICOS) categories as these are suited to systematic reviews that are being used to evaluate effectiveness studies (Moher, Cool, Eastwood, Olkin, Rennie et al., 1999). Following the formation of the question, a preliminary document search was completed to establish any systematic reviews in existence that addressed the proposed area of focus. This was to ensure that the review would not replicate existing publications. This also establishes a justification and rationale for the research, for example, if the systematic review is to serve a specific purpose or inform an aspect of future policymaking (Baumeister and Leary, 1997; Gough, Oliver and Thomas, 2013; Petticrew, 2001). The systematic review conducted here served both of these purposes: it enabled information about successful interventions for dyslexia support in HE to be identified and reviewed, and it also provided opportunity for the suggestion of changes to existing policy and practice. This made the completion of the systematic review justifiable and so the decision was made to progress.

4.2.2 The protocol

The systematic review protocol (see Appendix G) was developed as the overarching framework for the research process (PRISMA, 2009). The main function of the protocol is to limit bias, i. e. it helps to prevent the selection of individual studies that might support a preconceived view and reduces the risk of the analysis being led by researcher expectation (Kitchenham, 2004; Lipsey and Wilson, 2001; Petticrew and Roberts, 2006).

The PICOS (2010) guidance was used to develop the protocol for the systematic review to ensure that the characteristics of the planned study were outlined in full and that there was a clear plan of intent. The protocol includes an a priori statement of the design and methods used at each stage of the review. It includes features such as the conceptual underpinning of the review, the review parameters, the rationale for the research question being addressed, and the scope, intent and justification of the research question. It also contains the inclusion and exclusion criteria for the review, which were developed alongside the rest of the protocol, as one informs the other. Over the course of the completion of the systematic review, adjustments were made to the protocol. The adaptations made to the protocol feature in the background and rationale section, as the data in the protocol used national statistics published by the Quality Assurance Agency (QAA) and the NSS from 2011 to 2013 and required updating. The 2013–14, 2014–15 and 2015–16 data demonstrated a steadily increasing percentage of students on HE programmes in England identifying themselves as learning disabled (Hefce, 2016). This meant that the focus of the systematic review was still relevant and that the information contained in the protocol was up to date.

4.2.3 Searching and study retrieval

When planning the search strategy for the systematic review, there were three areas of interest that had become particularly relevant to dyslexia support and HE as a result of the website survey and documentary analysis (see Chapter 3). These three emerging areas (or themes) became apparent

during the process of coding, extracting and analysing the website data from the HEIs. The three themes are: teaching, learning and inclusive practice; additional learning support and study skills support; and ICT and AT. These emerging themes, or lines of further enquiry, provided a starting point in the development of the search strategy for the systematic review.

The PICOS categories were consulted to assist in the development of the search strategy for the systematic review to ensure that all the available, relevant documents were captured 'up front' (Newman and Dickson, 2012; Shadish, Cook and Campbell, 2002; Torgerson, 2003; Torgerson, Hall and Light, 2012). The search strategy contained a variety of terms that captured the 'intervention' and 'outcome' elements of the systematic review question, as well as other language pertinent to the research question, such as 'study support' and 'assistive technology'. It was also important to consider any synonyms of the key search terms during the development of the search strategy as terminology use can differ from article to article, even when the focus of the research is the same. Different conceptual viewpoints can affect the selection of language choice (Crystal, 1997). An example of how synonyms were integrated into the search strategy for the systematic review is the search term 'dyslexia', which was searched for in conjunction with 'specific learning difficulties' and 'specific learning disabilities' as these terms are often used interchangeably. This was to safeguard against missing relevant documents (Garg, Hackam and Tonelli, 2008).

The development of the search strategy for the systematic review led to the production of four variations of draft search strategies. A cyclical trial and review of the search strategy continued until a version was settled upon (version 5) which satisfied a number of requirements. The fifth one became the final version of the search strategy and was used in the conduct of the systematic review. The ongoing development and revision of the search strategy were reviewed by a second reviewer (CT) as a quality assurance mechanism. Versions of the search strategies were also retained as records, as

good practice dictates (Centre for Research and Dissemination, 2008; Newman and Dickson, 2012; Pino and Mortari, 2014).

In summary, the systematic review search strategy was developed to ensure that it searched for, identified and retrieved all studies which were relevant to the question. It was transparent and comprehensive, reflecting good practice (Centre for Research and Dissemination, 2008; Pino and Mortari, 2014; Torgerson, Hall and Light, 2012) and was constructed to reflect the gold standard (CONSORT, 2010), i.e. to ensure it captured all available relevant studies, including unpublished materials or 'grey matter'. The search strategy is located at Appendix H.

The searches for the systematic review were completed within a seven-day period from start to end and the dates of the searches were noted alongside all the information sources used, as recommended in PRISMA guidance (2009).

Another aspect of good practice reflected in the searching and retrieval process for the systematic review was the consideration of potential bias. Bias can become an issue of quality for systematic reviews should it not be addressed (Begg, 1994; Cochrane, 2017; Morrison, Polisena, Husereau, Moulton, Clark et al., 2012; Torgerson, 2003; Vevea and Woods, 2005). Sources of potential bias that were of particular relevance to the review included publication bias and location bias. Location bias occurs when a reviewer may settle upon documents that are easy to access, leading to less accessible ones being excluded; publication bias can occur when studies are included or excluded on the basis of their results only rather than the quality of the study design and methodology. This affects the overall validity of the systematic review data synthesis. For the systematic review, articles that were not available via the databases or physically there in the libraries were secured via inter-library loans in order for them to be considered for inclusion. Publication bias was avoided as no studies were included based on their results only; all studies were assessed for broader issues of quality using a

range of approaches. These were the CONSORT (2010) checklist for internal validity, guidance for measuring external validity (Campbell and Stanley, 1963; Centre for Innovation and research in Teaching, 2017; Rosnow and Rosenthal, 2002) and Cochrane guidance (Hannes, 2011) for measuring relevance.

The second stage of the search can include citation searching and checking the bibliographies of other reviews. Following this process, authors of publications that are potentially relevant to a review can be contacted in an effort to pursue any studies that may not have been published. This is also important to avoid location bias and publication bias. This was the case with the systematic review as a published literature review, identified via the searches, analysed a number of studies that could have been relevant so they needed to be located and evaluated. All but one of the studies in the literature review citation list were found electronically or gained via inter-library loans; however, one article was not available so the author was contacted and subsequently provided the unpublished article for consideration in the systematic review.

Once the database searches were complete, the search results were imported into a web-based reference management resource and grouped by database and search theme. This was to ensure that individual search results were kept separately and that records were transparent and traceable and the searches could be replicated by other researchers if desired (Hedges and Olkin, 1985).

The search results were then peer assessed and agreed by the second reviewer (CT) as good practice dictates (Hedges, 2012; Torgerson, 2003; Newman and Dickson, 2012).

4.2.4 Screening and study selection

Inclusion and exclusion criteria were developed in consideration of the research question and the parameters of the systematic review as outlined in the protocol. These criteria are necessary as: they ensure that the studies included are aligned with the research question; they are key to setting the parameters of the study and are therefore fundamental to the development of the search strategy; they stipulate the types of studies to be included and excluded from the systematic review; they are a practical guidance tool that help to keep the research on track; and they assist with the 'in or out' decision-making during the screening process (2008, Amit et al., 2008; Baumeister and Leary, 1997; Bem, 1995). The inclusion and exclusion criteria for the systematic review can be found in the Protocol (Appendix G).

The inclusion and exclusion criteria were applied via a traditional systematic review three-stage process (Centre for Research and Dissemination, 2008; Newman and Dickson, 2012; Torgerson, 2003; Torgerson, Hall and Light, 2012). Stage 1 was the pre-screening of the search results, which led to the removal of all documents that did not meet the inclusion criteria. This was then followed by stage 2 (or first-stage screening), which was completed on the documents that remained after the pre-screening stage. This stage involved the reading of both the titles and the abstracts to establish as far as possible whether the studies were relevant enough to warrant a closer look; i.e. whether they appeared to meet the inclusion criteria. If they did, they progressed to the third stage (or stage 2 screening). Stage 2 screening involved the reading of the whole papers and decisions were made as to whether the studies met the inclusion criteria. If not, they were removed at this point.

As recommended by Torgerson (2003) and Torgerson, Hall and Light (2012), two reviewers took part in all stages of the screening process for the systematic review to quality assure the study selection and study removal process. The second reviewer (CT) independently screened a minimum of 10% at each stage of the screening process. These were then cross-checked with the screening results of the

first reviewer to ensure there was joint agreement at each stage. At the stage 3 screening a small number of anomalies in decisions were discussed until final agreement was reached as to which studies were to be included or excluded in the systematic review data synthesis. This dual review process is an essential aspect of the quality assurance of any systematic review and reflects good practice (Petticrew and Roberts, 2006; Pino and Mortari, 2014; PRISMA 2009).

4.2.5 Data extraction

Two specifically designed data extraction sheets were developed to facilitate the data extraction process. These were created following both good practice guidelines and examples of recognised good practice (Campbell Collaboration, 2017; CONSORT, 2010; EPPI-Centre, 2017 and Torgerson, 2003).

One data extraction template was designed for data extraction from the single studies (Appendix J) and a further data extraction template was designed for extracting data from reviews included in the systematic review (Appendix L). These two pre-prepared sheets ensured that the data taken from each type of study was standardised and was therefore replicable (Hedges and Olkin, 1985; Pino and Mortari, 2014; Torgerson, 2003; Torgerson, Hall and Light, 2012). When preparing for data extraction, a decision was made to include quality judgements relating to the overall quality of the included studies as a section in the data extraction sheets. This approach was agreed, with the peer reviewer (CT), as a more effective process than capturing the quality information in a separate document. This helped to hold relevant data together and assisted with the data synthesis and quality appraisal of the included studies.

Once the data extraction sheets had been peer reviewed and agreed, the process of data extraction commenced. Each study's relevant key information and/or data was identified and entered into a data extraction sheet. The data was extracted from the studies in this systematic way using the relevant

sections of the extraction sheets to ensure the consistency of the types of data extracted in a way that was replicable.

Independent double data extraction was completed for all studies (CT) in order to ensure that this process was transparent, quality checked and time-bound (Centre for Research and Dissemination, 2008; Torgerson, 2003; Torgerson, Hall and Light, 2012). Regular discussions took place between the first and second reviewer (CT) during this process to ensure that there was agreement as to: the categorising of the study's design; the methods of data collection; the sample; the results; and the findings. This is a crucial aspect of quality assurance (CONSORT, 2010). The populated data extraction sheets can be viewed at Appendix K (single studies) and Appendix M (reviews). A summary of the data taken from the included studies can be found in tables 13, 14, 15 and 16.

4.2.6 Quality appraisal of the included studies

Completing an assessment of study design will help to guarantee a minimum level of quality in the studies to be included in a review (Campbell Collaboration, 2017; Centre for Research and Dissemination, 2008; EPPI-Centre, 2017; Gough, Oliver and Thomas, 2013; Petticrew and Roberts, 2006; PRISMA, 2009; Rosenbaum, 2002; Torgerson, 2003). Research suggests that studies of experimental and quasi-experimental design can be placed in a hierarchy of 'good quality indicators' (Centre for Research and Dissemination, 2008, pp. 10–11; Hernán and Robins, 2006) At the top of the hierarchy are RCTs with allocation concealment. The second in the hierarchy are quasi-experimental studies. These differ from the RCT as random assignment is not used to create the comparison groups. Given the above, it could be assumed that RCTs will be better quality than, for example, quasi-experimental design (QED), but this is not always the case, so further analysis and evaluation of the studies included in the review were completed. This was to ensure that the quality judgements considered a number of factors. This was particularly important given the nature of the final studies

in the review. But, as design is an important consideration of quality, the studies included in the review were initially sorted into design groupings to assist with commencement of the quality appraisal.

Three approaches to quality appraisal of the included studies were adopted for the systematic review to enable a judgement of overall quality. The first related to the design of the study and was an assessment of internal validity, or internal methodological coherence (Pino and Mortari, 2014; Torgerson and Elbourne, 2002). The second related to each study's external validity (its generalisability to the population (Shadish, Cook and Campbell, 2002) and the third was a study's relevance to the systematic review question (Gough, Oliver and Thomas, 2013; Hannes, 2011). The individual quality judgements given separately for each of the three areas were either 'low', 'moderate' or 'high'. This enabled an overall quality judgement for each of the single studies to be made. This balanced weight of evidence judgment provided an overall quality rating (or rigour rating) for each study (see below).

Each study's internal validity was calculated by evaluating it against the CONSORT checklist (2010). This was operationalised by recording the number of affirmative (Y), negative (N) or 'not stated' (NS) areas in the study against the 11 CONSORT checklist items, as each one represents an aspect of quality important to internal validity. Some of these checklist items are considered to be more important than others (see * items in the checklist). For a study to gain a high rating, it needed to be judged as meeting at least eight of the criteria and at least three of the most important aspects relating to internal validity. To be given a moderate rating, the study needed to be judged as meeting at least five of the criteria and within these, meet at least two of the items considered to be the most important for internal validity. Any studies that met five of the criteria but did not meet any of the good-quality indicators was given a moderate–low rating. Any that scored four or below were given a quality rating of low. This process enabled studies of lower evidential quality (or studies where the claims could not be clearly warranted by the evidence) to be categorised as such, viewed with a critical eye and for their shortcomings to be considered in the development of the data synthesis.

1.   Was the study population adequately described?

2.   How was the target sample size decided?*

3.   Was the intention to treat analysis used?*

4.   Was the unit or randomisation described (e.g. individuals or groups)?

5.   How was the allocation schedule generated?

6.   Was the randomisation process concealed from the investigators?*

7.   Were follow up measures administered blindly?*

8.   Was estimated effect on secondary and primary outcomes measures stated?

9.   Was precision of effect size estimated (confidence intervals)?

10.   Were summary data presented in sufficient detail to permit alternative analyses or replication?

11.   Was the discussion of study findings consistent with the data?

(CONSORT, 2010)

This process was repeated with criteria that related to external validity. External validity can be influenced by a number of factors; for example, the characteristics of the experimental population, the interaction of the experimental population with the research process, the research setting or environment, researcher influence and data collection methods. These factors influence the ability of a study to be generalised to the wider population (Campbell and Stanley, 1963; Centre for Innovation and research in Teaching, 2017; Rosnow and Rosenthal, 2002). The following questions were designed to calculate the studies' external validity.

The questions used are as follows:

1.   Could the study findings be generalised to the wider population given the experimental population characteristics?

2.   Could the study findings be generalised to other contexts?

3.   Could the study findings be generalised to other settings?

(Campbell and Stanley, 1963; Centre for Innovation and Research in Teaching, 2017; Rosnow and Rosenthal, 2002).

For relevance the studies were evaluated as having a low, medium or high relevance to the following question:

1.   Did the study relate to aspects of dyslexia support in higher education?

<div align="right">(Gough, Oliver and Thomas, 2013; Hannes, 2011),</div>

This systematic approach to the quality appraisal and judgement process for each single study was completed in a fair, transparent and replicable way and completed in tandem with the second reviewer (CT).

Following this process for the single studies, the quality appraisal of reviews was completed. This required a different approach as although quality judgements are made based upon the same areas as for single studies, the key difference is that the judgement is made according to: i) how the quality aspects of each study in the review were evaluated for quality; ii) how well the issue of quality was reflected in the final write-up of the review; and iii) the overall quality of the review itself, including the way it was conducted and reported its findings (Hardy and Bryman, 2009; Pino and Mortari, 2014; Torgerson, Light and Hall, 2012).

The completed data extraction sheets for single studies and reviews, with their overall quality judgements, can be located at Appendices K and M respectively.

The quality appraisal process for the included studies was completed as a tandem process alongside the data coding as both of these stages needed to be completed before the data could be considered for synthesis and discussion (Hardy and Bryman, 2009; Pino and Mortari, 2014; Torgerson, 2003). At this point, studies could still have been excluded from the systematic review as the inclusion of poor studies are detrimental to the reliability of any conclusions drawn in the data synthesis. A study

assessed as poor quality must have methodological issues that will in turn affect the validity of any outcome claims made in that study's findings. Subsequently, the inclusion of these studies in the systematic review data synthesis, without consideration of their quality issues, will make the conclusions drawn less reliable because they are based on evidence that does not warrant the claims made (Gorard, 2002). The quality judgements made for all included studies were quality assured by a process of 100% independent quality appraisal; in other words, 100% double data extraction was completed by both the first and second reviewer (CT).

The process of quality appraisal occurred in a number of stages. Data extraction for four studies was completed and the data extraction sheets were completed by both reviewers; a discussion took place to resolve any anomalies at this stage. The process was repeated for the remaining six single studies and the review with the final data extraction sheets' content being agreed by both the first and second reviewer (CT). The final stage was the agreement of the individual and overall quality judgements for each of the single studies and the review, and again this was completed in discussion with the second reviewer (CT).

4.2.7 Approaches to data synthesis and analysis

Once the data coding and quality appraisal of the studies were complete, the next consideration was the approach to data synthesis, which is the combining of the results of the included studies. A framework or structure had to be selected or developed to assist with the organisation of the extracted data for discussion and analysis (Centre for Research and Dissemination, 2008; Newman and Dickinson, 2012; Torgerson, Light and Hall, 2012). Torgerson, Light and Hall (2012) advise that the process of data synthesis for systematic reviews can be done in one of two different ways: qualitative narrative synthesis or quantitative or statistical meta-analysis.

Meta-analysis (Rosenthal, 1995) is used particularly where RCTs form the evidence base for the systematic review (Glass, 1976; Glass, McGraw and Smith, 1981; Greenland and O'Rourke, 2001; Lipsey and Wilson, 2001). The studies selected for inclusion in the systematic review were predominantly of quasi-experimental design (QED) and there was one literature review; this immediately led to reservations about the appropriateness of a meta-analysis. Also, as meta-analysis is a statistical synthesis of data that leads to a quantitative summary of pooled results, an adequate number of studies needs to be included in the meta-analysis for statistical between-group variance to be established (Borenstein, Hedges, Higgins and Rothstein, 2009). Finally, meta-analysis should only be considered when studies are homogeneous in nature (Mulrow, 1994). This was not the case with the included studies. They evaluated very different interventions, some which focused upon AT and ICT, some on structured-language programmes, for example, and some on differing instructional teaching techniques. The settings in which the studies were carried also varied greatly, for example, formal classroom teaching, casual drop-in and groups of learners taken out from the 'natural classroom environment' to take part in specific targeted interventions. Finally, the participants themselves were diverse, and the groups included in the studies had different population characteristics. For example, they were of varied age, gender and experience and were at different stages of their academic careers. This can be likened to Chapter 9 of The Cochrane Handbook's (2017) reference to the avoidance of mixing apples and oranges in a meta-analysis, as it will lead to unconvincing results. In consideration of these factors, meta-analysis was rejected as unsuitable and frameworks for narrative synthesis were sought.

Petticrew (2001), Field and Gillet (2010), Harden and Thomas (2005) and Noblit and Hare (1988) suggest that when evaluating alternative approaches to data synthesis, the research question should be the main consideration. This will ensure that the data is organised in a way that is suitable to answering the systematic review question whilst avoiding bias. Frameworks exist that can be used to guide the completion of a narrative synthesis (Silverman, 1993). This will add transparency to the

process of synthesis and ensure that reliability and credibility are maintained. Although existing guidance should be considered, reviewers can take the opportunity to develop their own frameworks for analysis should this become the most appropriate way to gain meaningful data (Torgerson, 2003). Both the Centre for Research and Dissemination (2008) and Gorard (2013) suggest that studies can be grouped in a number of different ways to aid the organisation of the data for synthesis and discussion. They can be organised into themes, in terms of 'like' characteristics/commonalities or by their design. They can also be organised and presented in multiple ways to enable analysis to take place from different conceptual viewpoints, as was the case with this systematic review. The Centre for Research and Dissemination (2008) also suggest the use of a four-element framework to support good-quality and robust data synthesis. These are: i) developing a theory of how the intervention works; ii) developing a preliminary synthesis of findings of the included studies; iii) exploring relationships between studies; and iv) assessing the robustness of the synthesis.

The approaches outlined above were combined and followed in the data organisation and synthesis for the systematic review. Firstly, the articles were read to gain an understanding of the interventions under discussion; this process was repeated for each of the studies and reviews included in the systematic review. Secondly, during the data extraction stage, the studies were read and reread to ensure data had not been missed. Thirdly, the text was aligned in relevant units of meaning reflective of the emerging themes (teaching, learning and inclusive practice, additional learning support and study skills and ICT/AT). Fourthly, the data was coded under each theme (as far as was possible) and the studies were then organised under the three emerging themes. This then enabled stages 2 and 3 of the Centre for Research and Dissemination (2008) approach to be applied. This enabled a preliminary synthesis of the data for each emerging theme to be completed and for potential relationships between the studies within themes and across themes to be explored.

Presentational issues then needed to be considered. Erzberger and Prein (1997) advise that a narrative approach to analysis for a systematic review can cause considerable problems with presentation when displaying results. However, Garg, Hackam and Tonelli (2008) suggest that where the primary studies differ in design, population, interventions and comparisons or outcome measures, it can be appropriate to report the results using texts and tables. Therefore, tables have been used throughout the results section of the data presentation, and synthesis and discussion section of the review to assist in the clear and logical presentation of the results and other data.

In summary, a narrative synthesis approach was selected using a thematic approach to data analysis as this was the most appropriate (Braun and Clarke, 2006; Noyes and Lewin, 2011).

Once data synthesis was completed, conclusions were drawn leading to the final stage of the systematic review process, which was the writing up (Petticrew and Roberts, 2006; Torgerson, 2003; Torgerson, Hall and Light, 2012). Systematic reviews become outdated quickly, as the search strategy developed for the completion of the searches is time limited (Newman and Dickson, 2012; Torgerson, Hall and Light, 2012). The writing up of this review was completed in a timely a manner as possible and within relevant guidelines (PRISMA, 2009).

4.3 Systematic review results and discussion

The four stages of the flow chart PRISMA (2009) (See Appendix O) were used to guide the searching, screening and decision-making process. Following the searching process, a full range of documents was evident in the search results (for example unpublished dissertations, book chapters) and this gave some assurance that all available, potentially relevant documents (including the grey materials) had been identified for screening and potential inclusion in the systematic review (Centre for Research and Dissemination, 2008; Newman and Dickson, 2012; Torgerson, 2003; Torgerson, Hall and Light, 2012). The searching process identified 7,925 documents, the records for these were held in an

electronic reference holding database (Endnote) where they were then de-duplicated, leaving 4,132 documents to be screened.

4.3.1 Pre-screening, first-stage and second-stage screening results

The next stage of the PRISMA flow diagram (2009) was the screening of the remaining 4,132 documents. At this stage the titles of each of the 4,132 documents were screened by title and abstract (first stage screening) . Any which were not relevant to the study were removed leaving 88 documents. These 88 documents were then read in full (second stage screening) and checked against the inclusion and exclusion criteria to determine their eligibility for inclusion. 11 documents were progressed for inclusion in the data synthesis. Both the first and second reviewer (CT) were inclusive in the pre-screening, first-stage and second-stage screening process, with 100% agreement being reached at this stage. 10% (400 documents) were double screened by the second reviewer (CT) at the first stage and 100% at the second stage.

Following the completion of the screening, data coding commenced. During this process it became apparent that the literature review (one of the final 11 studies) contained some studies of experimental design in its data synthesis. Therefore, in order to ensure that no potential documents/studies were excluded from the review (which would affect its academic robustness), a citation search on the review was completed. From this literature review citation search, an additional 15 studies were identified that had the potential to meet the inclusion criteria for the systematic review and therefore these were also put though the stage 1 and stage 2 screening process. Following this, four documents from the literature review citation search remained. The results of all of the searches, including the additional search, are in Table 5.

Table 5: Searching and screening results

Database	Date of searches	Date range	Number of hits (before de-duplication)	Number of hits (after de-duplication)	Through to stage 2 screening	Number in electronic format	Number sent for to inter-library loans	Number gained from inter-library loans	Number through to systematic review
Psych Info	09/02/2016	1966 – 2015	2274	1758	16	15	1	1	1
Education Resource Information Centre	09/02/2016	1966 – 2015	823	482	16	14	2	2	2
British Educational Index	09/02/2016	1966 – 2015	71	28	4	4	0	0	0
Education Research Complete	09/02/2016	1966 – 2015	994	394	23	22	1	1	5
Social Sciences Citation Index	10/02/2016	1966 – 2015	2196	1190	14	12	2	2	3
Cochrane Library	10/02/2016	1966 – 2015	2	2	0	0	0	0	0
Campbell Collaboration	10/02/2016	1966 – 2015	1550	263	0	0	0	0	0
Additional searches									
Literature review citation search (Hock, 2012)	11/04/2016	2012	15	15	15	11	4	4	4
Total			*7925*	*4132*	*88*	*78*	*10*	*10*	15

4.3.2 Data coding (data extraction) results

As indicated in Table 5, 15 documents (14 single studies and 1 review) progressed to the data extraction stage. At this stage, the two data extraction sheets that had been developed for the single studies and reviews were brought into use. Data extraction for all 15 documents was completed by both the first and second reviewer (CT), and each study and the review were discussed individually between the two reviewers; this combined scrutiny added to the rigour of the data extraction as it ensured that there was 100% agreement on the extracted data.

4.3.3 Stage 3 screening

Stage 3 screening is screening that takes place at the data extraction stage (Torgerson, 2003). This is the final check to ensure that all the studies included in the review synthesis are suitable to answer the review question. During data extraction, it became apparent that some studies did not fit the inclusion criteria sufficiently to progress to the data synthesis, the issue being that the study designs did not align closely enough to the ones required. Good practice dictates that if a document, on closer scrutiny, does not fit closely enough, it should be removed so as not to adversely affect the review's quality (Centre for Research and Dissemination, 2008; Newman and Dickson, 2012; Torgerson, 2003; Torgerson, Hall and Light, 2012). Six of the studies were removed at this stage for these reasons, as whilst they were described as of experimental or quasi-experimental design, on closer assessment they were not experimental and/or were not true interventional studies. They had used case studies, observations and sometimes interviews; they did not test for causal outcomes of an intervention and as such did not meet the inclusion criteria. The process of removing the six studies was quality assured by the second reviewer (CT) via double data extraction and a process of cross-checking. There was 100% agreement that these six studies were not appropriate.

This left 9 studies (8 single studies and one review) for data synthesis. The fully completed individual data extraction sheets for the 8 single studies and the literature review can be located in Appendices K and M respectively.

4.3.4 Quality appraisal and quality judgements

Research suggests that RCTS should be of a better quality (as they are the gold standard of experimental design) and any studies not in this design may be considered as having a poorer quality, relatively speaking (Centre for Research and Dissemination, 2008, pp. 10–11; Torgerson, 2003). In the systematic review there was one RCT, two studies that had a combined RCT design along with a QED element, and five studies that were of quasi-experimental design (one resembling a natural

experiment). Finally, there was the literature review which is represented separately because the quality appraisal process for this study differed from that used for the single studies. Table 6 demonstrates the studies organised by design features alone.

Table 6: Studies included in the review organised by design features alone

RCT	Combined RCT/QED	QED
Guyer, P. B. and Sabatino, D. (1989). The effectiveness of a multisensory alphabetic phonetic approach with college students who are learning disabled.	Zawaiza, R. W. and Gerber, M. M. (1993). Effects of explicit instruction on math word-problem solving by community college students with learning disabilities.	Ruhl K. L., Hughes, C. A. and Gajar, A. (1990). The pause procedure and/or an outline: effect on immediate free recall and lecture notes taken by college students with learning disabilities.
	Guyer, P. B., Banks, S. and Guyer, K. (1993). Spelling improvement for college students who are dyslexic.	Ruhl, K. L. and Suritsky, S. (1995). Efficacy of the pause procedure for enhancing learning disabled and non-disabled students' long and short-term memory recall of facts presented through lecture.
		McNaughton, D., Hughes, C. and Clark, K. (1997). The effect of five proof-reading conditions on the spelling performance of college students with learning disabilities.
		Osborne, P. (1999). Pilot study to investigate the performance of dyslexic students in written assessments.
		Taylor, M., Duffy, S. and Hughes, G. (2007). The use of animation in higher education to support students with dyslexia.

Literature review
Hock, M. (2012). Effective literacy instruction for adults with specific learning disabilities: implications for adult learners.

Quality judgements for the single studies were reached by a thorough process of assessment which was carried out from three perspectives. The CONSORT checklist (2010) items for internal validity were used to assess the studies' internal methodological coherence. Guidance from Campbell and Stanley, (1963); the Centre for Innovation and research in Teaching, (2017) and Rosnow and Rosenthal, (2002) guidance was used to assess the studies' external validity, and the Supplementary Guidance for Inclusion of Qualitative Research in Cochrane Systematic Reviews of Interventions (Hannes, 2011) was used to assess each study's relevance to the research aim and question. Explanations for the quality judgements for the single studies relating to each of the areas can be found below.

4.3.5 Quality assessment of internal validity

Four of the 8 single studies included in the review were of quasi-experimental design and did not use random allocation (CONSORT checklist 2010 items 4, 5, 6 and 7). These were the McNaughton, Hughes and Clark (1997), Ruhl and Suritsky (1995) and the Ruhl, Hughes and Gajar (1990) studies. One study, the Osborne (1999) study, was a QED reflective of a natural experiment. The main aim of randomisation is to eliminate selection bias by producing groups or units that are similar to each other and promote the use of probability theory to establish the likelihood of outcomes (Moher, Hopewell, Schultz, Montori, Gotzsche et al., 2010). Allocation to groups in these four studies included in the systematic review were organised in the majority of cases in a non-random manner. Either the participant's preference for attendance to scheduled sessions or a participant's general availability was the predominant factor that organised the participants into their respective groups. This was partly due to the nature of the research itself, which tried to maintain a natural teaching and learning environment and pattern of study for the participants. In doing this, however, there was minimal control over each of the experimental groups' participant characteristics, and therefore the results of any interventions could have been influenced by the diversity in the groups and their differing baseline data characteristics, for example age, gender, ethic grouping, reading and spelling ability, the time of day the experiments took place, prior educational experiences and so on. This makes it difficult to

measure any outcome effects of an intervention successfully, or directly attribute a measurable change to the intervention alone. The remaining four studies (Zawaiza and Gerber, 1993; Guyer and Sabatino, 1989; Guyer, Banks and Guyer 1993 and Taylor, Duffy and Hughes, 2007 used randomisation to allocate groups. However, there were other design flaws in the studies which reduced their internal validity and therefore their quality, for example, a lack of information about the use of blinded randomisation and the administration of follow up measures.

A related issue of quality was the use of treatment and control groups. In the evaluation of the single studies. The majority of the studies used comparison groups where, more often than not, the interventions were given to all participants, so both dyslexic participants and non-dyslexic participants received the same intervention. Therefore, the judgements made in the studies about the outcome effects of the interventions were based on the pre-condition, or characteristics, of the participants themselves, rather than by the usual comparison of a treatment and control group, which is the strongest experimental design to test how effective interventions may or may not be (Carroll, Patterson, Wood, Booth, Rick and Balain, 2007; Sibbald and Roland, 1998). In relation to the studies included in this systematic review, both the lack of random allocation and the use of comparison rather than treatment and control groups did affect the internal validity of the experiments and also, to some extent, the validity of any outcome claims made. There were additional issues of quality that were also considered in the quality appraisal process. Implementation fidelity, or the attempt to reduce extraneous factors (or nuisance variables) that can influence the outcomes of the experiment (Carroll et al., 2007; Greenland and O'Rourke, 2001) was an issue and was considered as part of the quality appraisal process as the studies were not carried out in controlled conditions. Control over the experimental conditions varied from study to study, and although attempts were made to minimise other influences, it could not be verified how successful this was. This cast doubt over whether any significant causal effects claimed in the studies were valid, as the interventions were not isolated fully from other factors.

The intention to treat analysis (CONSORT checklist 2010, item 3), which is the least biased way of checking for intervention effects (Newell, 1992), was used in only one of the single studies (Zawaiza and Gerber, 1993) These measures protect against bias caused by, for example, the exclusion of some results or the non-consideration of attrition, leading to inaccurate data interpretation and results. This does not mean that the remaining seven studies did not use the intention to treat analysis because it was not explicitly stated. Having said this, the omission of the intention to treat information from the studies does call into question the reliability and validity of the claims made in the seven studies; therefore their findings must be treated cautiously, especially given the low external validity of the studies.

In relation to the outcome data (or results) included in the studies and the judgements made as a result of these (items 10 and 11 of the CONSORT (2010) checklist), seven out of 8 of the single experimental or QED studies had enough detail in them to enable replication or alternative analysis to take place (item 10). The Taylor, Duffy and Hughes (2007) study was the only one where this level of detail was lacking.

Table 7 demonstrates the findings from this quality evaluation process for the studies' internal validity using items from the CONSORT checklist (2010). The asterisk indicates those aspects that are considered to be the most important aspects of internal validity.

4.3.6 Quality assessment of external validity

The external validity of a study can be affected by numerous factors; for example, the characteristics of the experimental population (age, gender etc.), how the study population interacts with the research process, the research setting or environment in which the experiment is conducted, researcher influence or bias, the appropriateness of the research design, the data collection methods used and the size of the sample population included in the study. A bigger sample size will help to

avoid low statistical power: the smaller the sample, the less likely a true effect of an intervention will be established (Bartlett, Kotrlik and Higgins, 2001). These factors (amongst others) influence the ability of a study to be generalised to the wider population (Campbell and Stanley, 1963; Centre for Innovation and research in Teaching, 2017; Rosnow and Rosenthal, 2002).

The outcome of the quality evaluation of external validity, as demonstrated in Table 8, shows that all of the single studies in the review had a low external validity. This was due to a number of factors. The first factor which influenced the external validity quality judgements was sample size. The smallest sample was 12 participants and the largest was 76. The average sample size was around 35 participants. Seven of the studies had 76 participants or fewer. Sample size can be a limiting factor for the wider applicability of the findings, as generalisable application to any broader population implies that a causal relationship will hold in various places, settings, persons, treatments or outcomes (Marczyk, DeMatteo and Festinger, 2005; Shadish, Cook and Campbell, 2002) and with small samples this is difficult to establish. In addition to this, all of the studies took place only once (were not replicated) and in only one setting, limiting their generalisability still further. Also, it is not made clear if the researchers were also the tutors/lecturers. These factors are reflective of the poor generalisability quality ratings for the studies as indicated in table 8. As a result, extreme caution was exercised when considering the generalisability of the findings in the systematic review data synthesis and discussion (see section 4.5).

4.3.7 Quality assurance of relevance

One question was used to evaluate relevance. This was a direct reflection of the overall study value in relation to the systematic review research aim and question. Six of the studies were judged as having a high relevance: these were Guyer and Sabatino (1989); Guyer, Banks and Guyer (1993); McNaughton, Hughes and Clark (1997); Ruhl and Suritsky (1995); Ruhl, Hughes and Gajar (1990) and the Taylor, Duffy, and Hughes (2007) studies, as they matched to at least one of the key emerging

themes. One was judged as moderately relevant (Zawaiza and Gerber (1993), as it focused upon areas that were less related to the general theme and aim of the systematic review and so was limited in its broader applicability to the emerging themes. Specifically, it focused upon problem solving in a mathematics context, which was relatively narrow as this only addressed one theme to some extent. The one study judged as being of low relevance (Osborne, 1999) focused on areas related to the assessment of learning for dyslexic learners, such as examination issues and the role of coursework assessment, also this study was more of a natural experiment and so did not assess interventions as such.. This provided some insights that were useful to the overall discussion of study support, but it was not as directly related to the study aim and question as the other studies. The quality appraisal outcomes for relevance are located in Table 9.

Table 7: Internal validity quality judgements for the 8 single studies using the CONSORT checklist (2010)

Checklist items	Study	Guyer et al. (1993)	Guyer and Sabatino (1989)	McNaughton et al. (1997)	Osborne (1999)	Ruhl and Suritsky (1995)	Ruhl et al. (1990)	Taylor et al. (2007)	Zawaiza and Gerber (1993)
Was the study population adequately described?		Y	Y	Y	Y	Y	Y	Y	Y
How was the target sample size decided?*		**N**	**N**	**N**	**N**	**N**	**N**	**N**	**Y**
Was the unit or randomisation described (e.g. individuals or groups)?		Y	Y	N	N	N	N	N	N
How was the allocation schedule generated?		Y	Y	NS	NS	Y	Y	NS	NS
Was the intention to treat analysis used?*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**Y**
Was the randomisation process concealed from the investigators?*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Were follow-up measures administered blindly?*		**NS**	**NS**	**N**	**N**	**N**	**N**	**N**	**N**
Was estimated effect on secondary and primary outcomes measures stated?		NS	NS	NS	NS	NS	NS	NS	NS
Was precision of effect size estimated (confidence intervals)?		NS	NS	NS	NS	NS	NS	NS	NS
Were summary data presented in sufficient detail to permit alternative analyses or replication?		Y	Y	Y	Y	Y	Y	NS	Y
Was the discussion of study findings consistent with the data?		Y	Y	Y	Y	Y	Y	Y	Y
NUMBER OF MOST IMPORTANT CRITERIA MET		0	0	0	0	0	0	0	2
NUMBER OF ADDITIONAL CRITERIA MET		5	5	3	3	4	4	2	3
TOTAL NUMBER OF CRITERIA MET		/11	5/11	3/11	3/11	4/11	4/11	2/11	5/11
Quality judgement for internal validity		**Moderate-low**	**Moderate–low**	**Low**	**Low**	**Low**	**Low**	**Low**	**Moderate**

KEY: Y = YES, N = No, NS = Not Stated

Table 8: External validity quality judgements for the 8 single studies

Items	Study	Guyer et al. (1993)	Guyer and Sabatino (1989)	McNaughton et al. (1997)	Osborne (1999)	Ruhl and Suritsky (1995)	Ruhl et al. (1990)	Taylor et al. (2007)	Zawaiza and Gerber (1993)
Could the study be generalised to other participants, given the experimental population characteristics?		M	M	M	M	M	M	L	M
Could the study be generalised to other settings?		L	L	L	L	L	L	L	L
Could the study be generalised to other contexts?		L	L	L	L	L	L	L	L
Overall Judgement		L	L	L	L	L	L	L	L

KEY: H = High, M = Moderate, L = Low

Source: (based on Campbell and Stanley, 1963; Centre for Innovation and Research in Teaching, 2017; Rosnow and Rosenthal, 2002)

Table 9: Relevance quality judgements for the 8 single studies

Items	Study	Guyer et al. (1993)	Guyer and Sabatino (1989)	McNaughton et al. (1997)	Osborne (1999)	Ruhl and Suritsky (1995)	Ruhl et al. (1990)	Taylor et al. (2007)	Zawaiza and Gerber (1993)
Did the study relate to aspects of dyslexia support in higher education?		H	H	H	L	H	H	H	M
Overall quality judgement for relevance		H	H	H	L	H	H	H	M

KEY: H = High, M = Moderate, L = Low

Source: Hannes, 2011.

4.3.8 Quality appraisal of the literature review

For the literature review (Hock, 2012), the overall judgement made was that it was of a moderate quality as there were a number of different study types included in the data synthesis. There were four experimental studies, eight of QED, seven single-participant studies and four judged as 'qualitative' (Hock, 2012, p. 66). This had an immediate impact upon the quality judgement made in relation to the nature of the systematic review question, as not all the findings and conclusions in the review synthesis were based on the outcomes of studies of experimental and quasi-experimental design. In addition to this, some important areas of quality appraisal were missing from the literature review; these were explanations of how the data was extracted, the characteristics of the included studies and information pertaining to trial flow (where relevant). The quality judgement summary for the review is represented in Table 10.

Table 10: Quality appraisal outcomes for the literature review

Author	Aims/question	Methods: Search	Methods: Selection	Methods: Validity assessment	Methods: Data extraction	Methods: Study characteristics	Methods: Data synthesis	Results: Trial flow	Results: Study characteristics	Results: Data synthesis	Discussion	**Overall quality judgement**
Hock (2012)	Y	Y	Y	NS	NS	Y	Y	NS	NS	NS	Y	**Moderate**

KEY: Y = YES, N = No, NS = Not Stated

4.3.9 Overview of quality judgements

Table 11 shows the quality judgements for the single studies and the review against three areas of internal validity, external validity and relevance, and provides a weight of evidence quality judgement (or overall rigour judgement) for each of the included studies.

Table 11: Weight of evidence quality judgements (overall rigour of included studies)

Authors and title	Design	Quality assured weight of evidence judgement
Guyer, B. P. and Sabatino, D. (1989). The effectiveness of a multisensory alphabetic phonetic approach with college students who are learning disabled.	RCT	1. External validity: Low 2. Internal validity: Moderate–low 3. Relevance: High **Overall rigour: Moderate-Low**
Guyer, B. P., Banks, S. and Guyer, K. (1993). Spelling improvement for college students who are dyslexic.	RCT/QED	1. External validity: Low 2. Internal validity: Moderate–low 3. Relevance: High **Overall rigour: Moderate-Low**
Hock, M. (2012). Effective literacy instruction for adults with specific learning disabilities: implications for adult learners.	Literature review	1. External validity: Moderate 2. Internal validity: Moderate 3. Relevance: High **Overall rigour: Moderate**
McNaughton, D., Hughes, C. and Clark, K. (1997). The effect of five proof-reading conditions on the spelling performance of college students with learning disabilities.	QED	1. External validity: Low 2. Internal validity: Low 3. Relevance: High **Overall rigour: Low**
Osborne, P. (1999). Pilot study to investigate the performance of dyslexic students in written assessments.	QED	1. External validity: Low 2. Internal validity: Low 3. Relevance: Low **Overall rigour: Low**
Ruhl, K. L. and Suritsky, S. (1995). The pause procedure and/or an outline: effect on immediate free recall and lecture notes taken by college students with learning disabilities.	QED	1. External validity: Low 2. Internal validity: Low 3. Relevance: High **Overall rigour: Low**
Ruhl, K. L., Hughes, C. and Gajar, A. H. (1990). Efficacy of the pause procedure for enhancing learning disabled and non-disabled students' long- and short-term memory recall of facts presented through lecture.	QED	1. External validity: Low 2. Internal validity: Low 3. Relevance: High **Overall rigour: Low**
Taylor, M., Duffy, S. and Hughes, G. (2007). The Use of animation in higher education to support students with dyslexia.	QED	1. External validity: Low 2. Internal validity: Low 3. Relevance: High **Overall rigour: Low**
Zawaiza, R. W. and Gerber, M. M. (1993). Effects of explicit instruction on math word-problem solving by community college students with learning disabilities.	RCT/QED	1. External validity: Low 2. Internal validity: Moderate 3. Relevance: Moderate **Overall rigour: Moderate**

In summary, none of the included studies were high quality. One study was judged to have a moderate overall quality - this was the Zawaiza and Gerber (1993) study, as this study had moderate relevance and moderate internal validity. Two of the studies had a moderate/moderate-low quality (Guyer and Sabatino (1989), Guyer, Banks and Guyer (1993); these were rated as moderate/moderate-low as they had a high relevance to the study but a moderate-low internal validity and a low external validity. Five of the studies were judged to be of low quality (McNaughton, Hughes and Clark (1997), Osborne (1999), Ruhl and Suritsky (1995), Ruhl, Hughes and Gajar (1990) and Taylor, Duffy and Hughes (2007)). These studies had major methodological flaws, and so had low internal validity and low external validity. Therefore, the outcome claims made in the studies are questionable as the evidence was not strong enough to warrant these claims (Gorard 2002). The single literature review (Hock, 2012) in the systematic review data synthesis was of an overall moderate quality.

All studies, when discussed in the findings, are treated with a level of caution which is reflective of how well (or not) the evidence base in the study supported the claimed findings.

4.4 Approaches to data analysis

Data was organised into the emerging themes so a logical and methodological approach to data analysis could be completed. This provided a coherent framework for discussion and reflection. The organisation of data into themes in itself was not a straightforward process, as some of the studies crossed themes. On categorisation of the studies into themes, there were three studies (the Ruhl and Suritsky (1995), Ruhl, Hughes and Gajar (1990) and Zawaiza and Gerber (1993) studies) which were judged as being more relevant to theme 1 than any other (teaching, learning and inclusive practice) theme. Three studies were judged as being relevant to theme 2 (additional learning support and study skills) support. These were the Osborne (1999), Guyer and Sabatino (1989) and the Guyer, Banks and Guyer (1993) studies. None of the single studies addressed theme 3 (ICT and AT) as an independent topic. However, two of the single studies (the Taylor, Duffy and Hughes (2007) and the McNaughton,

Hughes and Clark (1997) studies) did refer extensively to the use of ICT and AT within the wider context of the two previously identified themes of teaching, learning and inclusive practice and/or additional learning support and study skills support, and this so emerged as a sub theme. One was judged as having a moderate weight of evidence quality (the McNaughton, Hughes and Clark (1997) study) and one had a low weight of evidence quality (the Taylor, Duffy, and Hughes (2007) study). The literature review (Hock, 2012) was the final study to be categorised and this study contained data that embraced all three themes. Table 12 is a visual representation of the studies categorised into their related single and multiple themes.

Table 12: Studies organised under thematic categories

Main theme 1 Teaching and learning and inclusive practice	Main theme 2 Additional learning support and study skills support	Sub theme: 1 Information communications technology and assistive technology with Teaching and learning and inclusive practice	Sub theme: 2 Assistive technology and information communications technology with Additional learning support and study skills support	Across all themes and sub themes
The pause procedure and/or an outline: effect on immediate free recall and lecture notes taken by college students with learning disabilities.	The effectiveness of a multisensory alphabetic phonetic approach with college students who are learning disabled.	The use of animation in HE to support students with dyslexia.	The effect of five proofreading conditions on the spelling performance of college students with learning disabilities.	Effective literacy instruction for adults with specific learning disabilities: implications for adult learners.
Efficacy of the pause procedure for enhancing learning disabled and non-disabled students' long- and short-term memory recall of facts presented through lecture.	Spelling improvement for college students who are dyslexic.			
Effects of explicit instruction on math word-problem solving by community college students with learning disabilities.	Pilot study to investigate the performance of dyslexic students in written assessments.			

4.5 Data presentation, synthesis and discussion

The data presentation, synthesis and discussion encompass the two main themes of teaching, learning and inclusive practice, and additional learning support and study skills support, and the sub theme of ICT and AT. The data presentation and analysis begin with the literature review (which reflected all of the emerging themes) and then addresses the single studies aligned to their related themes.

4.5.1 Studies that related to all themes: overview of literature review

Hock's (2012) *Literature Review: Effective literacy instruction for adults with specific learning disabilities: Implications for adult learners* covered all three themes within its content. This was expected, as the study was a review of literature that focused upon effective literacy instruction for adults with specific learning disabilities and covered a large range of teaching and learning situations. This review was a discussion of 22 individual studies with a variety of designs, for example case studies, surveys, experiments and quasi-experiments. The discussions and conclusions in the review can be linked to the three main lines of enquiry for this research. The review was judged to be of a moderate overall quality (see section 4.3.9, Quality appraisal of the literature review). The setting, design and overall relevance were moderate, but the demonstrable significant effects were low because of the mixed nature of the review's included studies.

Table 13 contains the data extracted from the literature review. This is an amalgamation of the information for each of the studies included in the literature review and provides a summary of all features of the studies stated in the review. It includes the review question and aim, the design of the studies included in the review, data synthesis, results and discussion. As explained in section 4.3.9, Quality appraisal of the literature review, also, some aspects of the process were not explicitly stated, which contributed to the overall quality judgement of moderate.

Table 13: Characteristics of the literature review included in the systematic review

Name/nature of review and bib details	Aims/question	Methods: Search	Methods: Selection	Methods: Validity assessment	Methods: Data extraction	Methods: Study characteristics	Methods: Data synthesis	Results: Trial flow	Results: Study Characteristics	Results: Data synthesis	Discussion
Hock, M. (2012). Effective literacy instruction for adults with specific learning disabilities: Implications for adult educators. *Journal of Learning Disabilities* 45(1), pp. 64–78.	'Literature on adults with Learning Difficulties/(LD/ LDs) is reviewed and evidence-based instructional practices that significantly narrow the literacy achievement gap for this population are identified.' (p. 64).	Literature search guided by questions related to evidence-based practice (p. 65 has details of the three areas of focus). Database searches were conducted. Searches limited to studies conducted after 1990. The descriptors used in the searches are on p. 66. The searches were not as 'tightly' managed as the SR above.	Qualitative, quantitative or empirical research studies were included if they met the inclusion criteria: 1. Pertained to adults or older adolescents (<16 (included in final study) with LD; 2. They pertained to instructional methods for reading, writing, spelling, vocabulary, math, science or social studies. 223 articles and dissertations were found for screening. 11 were 'think pieces' and removed. 190 adolescents so removed, leaving 22.	N/S There is a note of caution at the end re: generalising the 'findings' from this study into ABE settings.	N/S	A mixture of experimental studies (4); quasi-experimental (8), single participant (7), qualitative (4). These were divided by type and then by age range (adults v older adolescents) and then categories of skill type, e.g. reading, spelling, math (p. 66).	The three questions outlined on p. 65 led the approach, which is thematic analysis (but this is not explicitly stated in the article).	N/S	N/S	Hard to distinguish specifics. There is extensive discussion under the themes identified on p. 65 which focus primarily on the use of explicit instruction.	Main findings are: 'Explicit instruction continues to be a practice supported by research for adolescents and adolescents with LD. They respond positively to this. Teachers can improve students' learning of skills, strategies and content by: a) providing clear explanation of contents, skills, learning routines and strategies; b) modelling the cognitive and metacognitive behaviours associated with learning; c) co-constructing with students the strategies and routines that make learning more effective; d) engaging students in extensive practice that includes both guided and independent activities and elaborated feedback on each performance; and e) providing support for planning both proximal and distal generalization of skills, knowledge and strategies for learning.' (p. 73). 'Practitioners can (and should) incorporate proven instructional practices into their daily instruction.' (p. 74).

Source: Torgerson, 2007, p. 293.

Discussion and results of the literature review

The literature review proposed a number of outcomes and findings based upon the evidence provided by the studies in its data synthesis.

The first of these is that explicit instruction continues to be a practice supported by research in terms of its usefulness to the promotion of learning for those with and without a specific learning difficulty. There are a number of other teaching and learning approaches that can be utilised by lecturers and teachers alike to support dyslexic students' learning of skills, strategies and content. According to Hock's (2012) findings, this can be achieved by providing clear explanation of the contents of a session and the skills to be gained during that session, alongside the use of repetitive learning routines and strategies. These strategies can include modelling the cognitive and metacognitive behaviours associated with learning. This is reflective of the structured approaches adopted by programmes such as Alpha to Omega (Hornsby, Shear and Pool, 2006) and the Dyslexia Institute Literacy Programme (Walker and Brooks, 1998). All of these reflect an effectively structured plan of learning that enables overlearning and reinforcement and thus new knowledge to be built on prior knowledge gained. These can also be aligned with other models of learning, such as strategic content learning (SCL) and the strategic instruction model (SIM), where specific approaches, routines and strategies for learning are developed.

All of these approaches to teaching and learning can be promoted by breaking down and rebuilding with students the strategies and routines that make learning more effective for them as individuals. It is true that working with students to ascertain the approach that works for them relies to some extent on the learner understanding his or her strengths and areas of weakness in learning. Usually, adults with dyslexia can verbalise this, which can be of great assistance to the teacher (Lee, 2002).

Hock (2012) suggests that 'Practitioners can (and should) incorporate proven instructional practices into their daily instruction.' (p. 74). It is up for debate as how this statement can be interpreted. If, for example, tutors already use animated slides in their sessions and encourage the use of a word-processor with a spell checker in completing tasks in class (something that is relatively easy to incorporate into a session), then perhaps it is feasible to incorporate these into a daily teaching and learning routine if they are viewed as effective 'proven instructional practices'. Adult learners with more severe issues associated with dyslexia may need a more specialist approach to how content is delivered, such as multi-sensory approaches, if they are to be given the opportunity to learn as effectively as their peers. As explored in Chapter 2 (the literature review) and later in this chapter, if a tutor has limited training regarding the use of effective methods to promote learning for adults with developmental dyslexia, e.g. knowledge of how to use multi-sensory approaches and how to evaluate whether short-term or working memory is an issue, and then what to do about it, additional learning support, as an intervention, may not be effective.

If not provided with guidance and/or the appropriate professional development, tutors and/or lecturers will not be in a position to put appropriate strategies in place to support the learner. Only the trained dyslexia specialist or mentor will be able to address these issues if the dyslexia is relatively severe.

It is also suggested in Hock's (2012) literature review that engaging students in extensive practice, which includes both guided and independent activities, is beneficial. 'Extensive practice' is defined in the literature review as a range of different approaches and methods to secure learning. The utilisation of extensive practice and the various strategies within this would be supportive to the learning of adults with dyslexia. The wider and more diverse the range of activities presented for completion, the more likely it is that the learners' most advantageous channels for learning will be taken advantage of at some stage during these various and extensive activities.

'Providing support for planning both proximal and distal generalization of skills, knowledge and strategies for learning' (Hock, 2012, p. 73) is also cited as being advantageous when promoting learning for adults with dyslexia. This means that students with dyslexia should be provided with opportunities not only to practise, learn and develop these skills in the classroom, but to be able to practise, learn and develop these skills away from the classroom (and so in other learning contexts). However, an adult learner with dyslexia must be provided with clear instructions that are constantly accessible (for checking and reminding as they may forget instructions) in order to assist them in completing tasks. This is particularly important in independent learning situations as, for example, providing only a verbal set of instructions for a task that is to be completed as a 'distal' piece of work is likely to lead to failure because instructions can easily be forgotten (i.e., not internalised at the point of instruction delivery due to short-term memory and processing issues).

Even something as straightforward as the recording of instructions for later playback (and auditory rehearsal) can help to relieve the burden on a deficient short-term memory as opportunities for repeated hearing are available (Baddeley, 1986). In addition, reading pens and note-taking AT and the features and functions of these have also proven of some benefit for reading comprehension (Schmitt, 2012). These types of assistive technology can also be used for taking notes and note-taking strategies for learners with dyslexia (Belson, Hartmann and Sherman, 2013) and can be used as effectively away from the classroom setting as in it. It can be summarised that ICT and various other types of AT could have a significant influence on access to learning.

There are also a range of other, 'softer' skills related to learning and progression that are discussed in the Hock (2012) literature review. These softer skills relate to a number of additional skills outside the skills of reading and writing, such as the ability to plan and organise time, to study independently and to remember key dates such as assignment deadlines (temporal awareness can be an issue). If we also consider that short-term memory is problematic, then organising him- or herself to remember to

complete a task, or general 'forgetting' (which can seem like absent mindedness or a lack of interest), can also be an issue.

Finally, it is suggested that elaborated feedback on each performance that supports learning is beneficial. Again, this is open to interpretation, and there are many disagreements regarding what constitutes 'useful feedback' (Hattie and Timperley, 2007). Also, written feedback that is extensive and includes complicated language may be of little use to the adult with dyslexia. Elaborated feedback on each performance can promote learning, but only if the format and content are accessible to an adult learner with dyslexia. An example of how to facilitate accessible detailed feedback to a learner with dyslexia may be the provision of oral feedback in digital format, which can be repeat played until understanding is gained, and which also contains concrete examples of 'what is wrong' with the work and how to 'put it right', possibly via model answers (Hattie and Timperley, 2007). This format of feedback, which is again arguably relatively easy to supply, may provide great benefits to not only the adult learner with dyslexia, but learners in general who utilise auditory routes in learning. The discussion of the literature review and the findings below was formed with full consideration of the moderate quality judgement given and the implications of this, as indicated in section 4.3.9.

Literature review: key findings

The main finding from Hock's (2012) literature review of individual studies suggests that:

i) There are a range of strategies and activities that could be utilised more effectively to promote the learning of those with dyslexia.

ii) Training and development of staff in knowing and being able to use these methods (including some knowledge of the benefits and use of multi-sensory teaching and learning approaches) are a notable factor in the successful promotion of learning for adults with specific learning disabilities, such as dyslexia.

iii)   Some types of ICT and AT can provide increased access to learning for the adult learner with dyslexia.

4.5.2 Teaching, learning and inclusive practice: results and discussion

Table 14 is a sub-component of the data extraction sheets located in Appendix K and draws together the pertinent information from these six studies into a summary to enable a structured, logical discussion to take place which is grounded in the evidential data presented. This information was used as the basis for the critical evaluation and discussion.

Table 14: Data summaries from studies within the emergent theme of teaching, learning and inclusive practice

Study details	Study focus	Design and methodology	Findings
Ruhl, K. L., Hughes, C. A. and Gajar, A. (1990). *The pause procedure and/or an outline: effect on immediate free recall and lecture notes taken by college students with learning disabilities*	This study evaluated the impact of the IV of pausing in lectures and directed discussion during the pauses	Quasi-experiment using a four-group, three-phase design. Sample was 15 learning disabled (LD) and 15 non-learning disabled (ND) participants. Phase 1 – students split into two groups of 15 (A and B). Both contained students with learning disabilities. All were presented with the same lecture without pauses. Phase 2 – Group A received the lecture with pauses and discussion and Group B were presented with the lecture without pauses. The learners with LD were diagnosed using a discrepancy model with a difference of at least 40 percentiles. The ND were from courses in special education but assumed to be non-disabled. Mean age of LD was 22.64, and for ND was 22.04. The sample was diverse in terms of gender and ethnicity. Demography of the participants showed no significant differences. This was used to evaluate its impact upon the DVs (outcome measures) of immediate free recall (IFR) and long-term free recall (LFR) and test performance (correctness measures). Moderate quality.	T-tests showed significance between group differences in phase 2 only. The group receiving the pause did significantly better on IFR2 ($t = 3.28$, $df = 28$, $p < 0.5$) and T2 ($t = 3.75$, df, $= 28$, $p < 0.5$). (p. 62). The use of the pause procedure is effective in promoting learning for both learning disabled and non-learning-disabled students. This was the most successful out of all the conditions in promoting the comprehension of the lecture content for immediate free recall, long-term recall and correctness measures in the tests. The study findings also highlight a secondary finding. If learning is made more accessible, the LD student will not have to seek additional assistance from an instructor or fellow student and that this will, 'prevent any of the embarrassment or discomfort associated with this.' (p. 63)
Ruhl, K. L. and Suritsky, S. (1995). *Efficacy of the pause procedure for enhancing learning disabled and non-disabled students' long- and short-term memory recall of facts presented through lecture*	This study evaluated impact of three different IVs: a pause procedure in a lecture (P), an outline of the session with a pause (O/P) and an outline only with no pause (O).	QED. All 33 participants received one of the interventions (three groups of 11 participants). All the participants had an identified learning disability. All were diagnosed using a discrepancy model with a difference of at least 40 percentiles. The sample was diverse in terms of gender, ethnicity and age (22.88 mean age). Demography of the participants showed no significant differences. These were used in a lecture to evaluate their impact upon the DVs (outcome measures) of immediate free recall (IFR), percentage total correct (PTC) and percentage partial correct (PPC) as a measure of achievement. Moderate quality.	'A one-way MANOVA in the dependent variables of IFR and PTC and PPC indicated the effect for group was significant ($F = 3.891$. $df = 3/29$, $p = <0.1$) (Wilks). Bartlett's Test for individual variance components indicated statistically significant group differences only on IFR and PTC. For IFR the pause (P) group was superior to both outline and pause (O/P ($t20 = 2.291$)) and outline alone (O $t20 = 2.958$) which were both equally effective. For PTC, both P and O/P were superior to O ($t20 = 4.078$; $t20 = 2.2498$ respectively).' (p.7.) The most significant effect was on the P group, followed by the O/P and the O. The hypothesis of the study was that O/P would be superior to P alone and O alone as double aid to support recall. In fact the study findings indicated instead that the use of the outline prompt was an unnecessary distraction and did not benefit learning.

Study details	Study focus	Design and methodology	Findings
Zawaiza, R. W. and Gerber, M. M. (1993). *The effects of explicit instruction on math word-problem solving by community college students with learning disabilities*	This study compared how different types of instructional techniques may or may not influence learning in a maths problem solving context.	Combined QED alongside a randomised controlled element of pre-test and post-test design. The sample comprised volunteers. 22 maths-competent peers were also pre-tested and used as a normative sample for validating the poor pre-test performance of the LD students, though they did not participate in the experiment itself. This study used three groups of 13 participants. Two of the groups were exposed to different specific interventions and the third group had no intervention (the control group). The first group (Translation (T) group) was taught explicit methods for translating compare-type word problems. The second group (Diagram (D) group) was taught the same translation methods and taught how to diagram relationships between word-problem components schematically and to develop an action schema. The attention control group was exposed to similar problems without explicit problem-solving instructions. The outcome measure was solution accuracy. There was a mixture of learning disabled and non-learning-disabled participants across all the groups. Moderate quality.	'The D group outperformed both the T and the AC group with differences in reducing reversal errors (1.1 to 0.4) reducing compare problem errors (2.8 to 1.4) and increasing correct answers (11.0 to 12.7). The AC group had slight increase in correct answers (9.3 to 10.4), decrease in compare-type errors (3.9 to 3.2) and decrease in reversal errors 2.2 to 1.8).' (p74.) 'Only the D group achieved near to the correct scores of the math-competent peers (MC = 13.8 pre-test) D scoring 12.7 post-test.' (p. 74) The conclusions claim that the students receiving the instructional and schema training combined (the D group) improved significantly more than the students assigned to instructional linguistic training (the T group) and the control group on solving compare-type word problems. There were some issues with the claims made in relation to what the data proved: the authors claim that their hypothesis of the D group outperforming the other groups was upheld, but the claims are overstated. The study findings suggest that, 'Post-secondary students with specific learning disabilities are responsive to strategy instruction and can change their problem-solving behavior accordingly.' (p.78), or to put it another way, using specific strategy instruction can promote effective learning for learners with dyslexia.

The pause procedure

The Ruhl et al. (1990, 1995) studies evaluated the use of variants of a pause procedure in lectures and were of a similar design. Both studies attempted to establish whether the use of a pause procedure improved the recall of the lecture content for the learners for a range of outcomes. The 1990 study had three types of outcome measures: immediate free recall (IFR), total correctness (TC) and long-term recall (LTR). These were tested following attendance to three separate lectures across two quasi-experimental groups. In phase 1, none of the groups received the intervention; in phase two, one group received the intervention and in phases 2 and 3, both groups received the intervention. A significant difference in performance was found only in phase 2 of the study, where one group received the intervention and the other did not. This significant difference was found for IFR and total correctness (TC) only. The group receiving the intervention did significantly better in these outcome tests (IFR2 (t = 3.28, df = 28, p <0.5) and T2 (t = 3.75, df, = 28, p <0.5)). The pause procedure itself is defined in this study as three, two-minute periods within lectures where students engage in discussion and note-taking. The discussion in this study was directed (instructions for the content of the discussion were provided) and participants were paired (an LD and ND participant) during this part of the process. The pause procedure was effective in improving IFR and performance in the tests for both learning disabled (LD) and non-learning disabled (ND) students. LTR was not significantly affected across all phases for both LD and ND students.

The Ruhl et al. (1995) study tested another variant of the pause procedure. In this study, all of the participants were LD and were randomised into three groups. One group received the pause procedure intervention only (P), one group received the pause procedure intervention and an outline of session notes (O/P) and one group received the outline of session notes only (O) and no pause procedure. As before, the subjects in the pause procedure groups had facilitated discussions as part of the procedure, though these were directed by ND-trained peers from the same programme, since the authors claim that under non-experimental conditions, students would have access to other

learners who were ND as part of the normal discussion and note-reviewing/taking process. The peers were used to direct the discussion and to ensure that the pause discussion time was used as the experiment required (treatment fidelity). The period of the pause procedure did not differ (three, two-minute periods). The outcomes to be measured were immediate free recall (IFR) scores and completeness of notes (PTC, percentage total correct, and PPC, percentage partial correct). The findings claimed that effect for group was significant on IFR and on PTC. The pause procedure alone, however, led to a significantly superior performance in IFR for the P group ((O/P ($t20 = 2.291$) and outline alone (O $t20 = 2.958$)). For PTC, the P and O/P groups performed equally well and were superior to the O group (O ($t20 = 4.078$; $t20 = 2.2498$) respectively). Overall, the O group's intervention was the least effective.

The internal validity of the two Ruhl et al. (1990, 1995) experiments is low as it is not stated whether allocation to groups was blinded and all the participants were either all LD, or the LD and ND participants were mixed (comparison rather than control groups). Also, secondary outcome measures were not specified in either study. They did, however, use analysis of variance testing to validate claims of significant outcomes. Their external validity (generalisability) is low. They have a high relevance to the systematic review as they evaluate how learning opportunities can be improved for adults with specific learning difficulties by adaptation to classroom practice. The studies were given an overall rigour judgement of low. The low quality judgement suggests that the findings and claims have little validity based upon the quality criteria used to assess the studies. The main findings of the studies suggests that the pause procedure is effective in supporting improved IFR and for the answering of short-answer tests taken immediately after a session. The directed and facilitated discussions were important to the review of the lecture content and the consolidation of this into higher quality and more complete notes taken by both the LD and ND students. LTR was not affected significantly in either of the studies. This indicates that the pause procedure only has effect for short-term learning and the assimilation of information into notes. Although the learning is not long term

or secure (which is unsurprising), the improvement in the quality and completeness of notes taken during the sessions, it could be argued, provides a more secure base for consolidation or revision of materials at another time, and therefore could better support longer term learning. The 1990 study also suggested that making these pause procedure modifications to lecture delivery will support learning for all and remove the need for an LD student to seek additional support from tutors or fellow students, thus reducing the need for assistance. The 1995 study had an additional finding. It hypothesised that the pause procedures used alongside an outline of lesson content or notes would be more effective than the pause alone, but this was not the case. This called into question the usefulness of handouts to support learning in lecture situations when they actually could be a distraction from the effective aspects of note-taking and directed/facilitated discussion during the pauses.

Discussion is one aspect of the pause procedure outlined in the Ruhl et al. (1990, 1995) experiments. This can be viewed as articulatory rehearsal. Articulatory rehearsal is the process of repeating and/or discussing content that has recently been heard in an effort to assist a learner in holding information in his or her short-term memory, with a view that it may eventually promote longer term learning and recall. The process of articulatory rehearsal is a vital component of multi-sensory or multi-modal learning which has been seen to be effective for learners with dyslexia (Lee, 2002; Hornsby, 2005; Frith, 1997). This occurs as articulatory rehearsal supports the process of information transfer from the short-term to the long-term memory and back again (Baddeley, 1986). The pause procedure, if used as defined in the Ruhl et al. (1990, 1995) studies, enables the process of articulatory rehearsal (discussion) to take place. The articulatory rehearsal within the pause procedure would be particularly useful for learners with dyslexia who find it more difficult to assimilate and process information which, in lectures, is often delivered at speed and contains new vocabulary and concepts for the learners to grapple with. This is usually carried out without providing opportunities for consolidation via discussion, comparison of notes etc. Usually, the consolidation activity is left to the seminar. This

makes lectures a particular issue for learners with dyslexia due to their deficits in phonological processing, short-term memory capacity and coding, and their diminished ability to engage in the content as effectively as their peers, as discussed in the literature review (Breznitz, 2008; Gathercole and Pickering, 2000; Swan and Goswami, 1997b; Tallal, 1976).

Successful articulatory rehearsal relies on self-actioned learning, or the use of a facilitator such as a peer or prompter to direct activity in order to make it most effective (Dyslexia Action, 2017a). Within the pause procures used in the Ruhl et al. (1990, 1995) studies, in one group there was the use of non-disabled peers to support the process of discussion and note-taking (1990) and trained confederate mentors in the other group (1995) where all the learners were LD, carrying out the same role. This was, in effect, enabling directed articulatory rehearsal by providing the opportunity for the participants to discuss and repeat key points of the lecture, in three separate instances, 'out loud'. An additional benefit to this process was that the quality and completeness of the notes students made during this process significantly improved, providing a stronger base for future learning, should the notes be used to support assignment writing or other topic-related learning and assessment tasks at a later date.

If we were to take the pause procedure as delivered in the Ruhl et al. (1990, 1995) studies, which showed some benefits to learning, particularly in relation to immediate recall and note-taking, and apply this process to general practice in HE, several potential issues become apparent. Organising lectures that ensure that there are pauses and opportunity for discussion is one thing, but making the pauses work well to support learning and note-taking is another, and in the Ruhl et al. (1990, 1995) studies, this was reliant upon facilitated direction, in one study, by a peer who was more able, and in the other by a trained facilitator/mentor. From a pragmatic perspective, the planning and execution of lectures in such a way across mass HE delivery would be nigh on impossible. Given the number of lectures, the potential unwillingness of staff to consider the additional aspects of planning and

execution that would be required to do this effectively is likely to be an issue. Further to this, the need

to train and introduce mentors into the lecture (or alternatively ensure the more able learners in the

lecture understood and could direct the activities of their peer learners well enough) is significant

additional work. To make this happen, the outcomes from such interventions would need to be seen

to be worthwhile. There are available alternatives to using the pause procedure as defined above that

are less disruptive. A potentially more manageable option to this kind of learning and teaching

approach is called the Think Aloud Procedure (Berne, 2004) which has shown some success in

supporting learning. In the Think Aloud Procedure, a series of stops and starts are used during the

delivery of materials and the learners are encouraged to verbalise the thoughts that come into their

head in relation to this during the stop time. This is done in a way which, it is claimed, promotes the

assimilation of learning using a type of pause procedure. It is the verbal equivalent of the cartoon

thought bubble. This method utilises the verbal and auditory channels of learning simultaneously,

which is a desired outcome for this approach to learning, and is one aspect of the Ruhl et al. (1990,

1995) pause procedure. The Think Aloud Procedure would be less resource intensive than the option

of using trained mentors in sessions and this would appear, at face value, to be something that could

be more readily implemented across a mass delivery situation. What this does not do, however, is

directly support the development of good-quality note-taking, which was one positive outcome from

the use of the mentors in the 1995 study. The other interesting observation from the Ruhl et al. (1990,

1995) studies was that the provision of handout materials summarising lectures or lecture notes did

not have a positive impact on the outcomes being measured in the studies; in fact, it acted as a

distraction. Therefore, the provision of handouts to support learning, a standard practice in some HE

classrooms, does not have a positive impact on immediate recall of information, or more significantly,

on the longer-term recall of information. The use of a planned pause procedure is a curriculum delivery

adaptation, or an adjustment, which is different from the recognised traditional lecture delivery is an

intervention that has had some success. It was seen to promote inclusive learning opportunities for

all learners, including those with dyslexia, as it facilitated learning in a number of ways. It supported

the immediate recall of facts as well as facilitating the production of more complete and better quality notes, helping the information to be captured more effectively, with a hope that it might be assimilated and internalised beyond this surface learning (Fry, Ketteridge and Marshall, 2009). Alternatives such as the Think Aloud Procedure may support verbal assimilation and learning to some extent, this would not harm the learning process, and, if coupled with directed peer discussion and note-taking in structured pauses, in a lecture of mixed-ability peers, would have some impact upon the recall of facts short term and the quality and completeness of the notes produced.

Summary findings from the pause procedure discussion are:

- The use of a pause procedure in lectures may help to promote learning for all participants, including those with specific learning difficulties such as dyslexia.

- The provision of handouts or outline notes in lectures does not appear to enhance learning.

Instructional techniques

Zawaiza and Gerber (1993) focused upon adaptations to classroom delivery to test how different approaches to problem solving impacted upon groups of learners with specific learning difficulties. It has a mixed QED and RCT design. This study was judged to have a moderate internal validity as the Translation (T) and the Diagram (D) groups each had 22 LD learners allocated to them, a reasonable sample size, but the study does not state whether this was blinded. There was also a high level of absenteeism in the D group, lthough the study claims these learners were replaced with 'like' learners (taken from the original 58 volunteers), it does call into some doubt the consistency of the data taken from this group. There are also some issues around the varied prior achievement levels of the sample of learners with LD, as there were limited controls around this. The external validity of the study is low, and its generalisability into classroom practice that is not maths based is limited. The relevance to the systematic review is moderate as it does measure how different types of instruction can

influence learning in a positive way. Although in this instance it is limited to a mathematics context, it is important to remind ourselves that maths is as much a language-based coding system as a numerical one, for it contains verbal labels such as plus, minus, nine, 10, percentages, fractions and so on. All of these have verbal codes (names) and meanings (morphology) that need to be learnt and understood before the process of calculation itself can be completed.

The study outcomes claim that post-secondary students with specific learning disabilities are responsive to strategy instruction and can change their problem-solving behaviour as required. This is demonstrated as the post-test reported performance of the group supported the proposed hypothesis that the D group (the only group receiving explicit diagramming instruction) would perform significantly better in the tasks than the other two groups, as they did, although this is somewhat overstated. A more notable outcome was that the D group performed, at post-test, to a level comparable to their maths-competent (MC) peers, (MC = 13.8 pre-test) and D scoring 12.7 post-test. (Zawaiza and Gerber, 1993, p. 74). The MC group were tested only once at the beginning of the study and the performance data was used as a comparison point.

Although the Zawaiza and Gerber (1993) study focused upon one aspect of learning only, i.e. problem solving, some of the strategies relating to specific strategy instruction such as that in this study can be related to broader cognitive instructional learning skills strategies. Two of these are the Strategic Instruction Model or SIM (Ellis, Deschler, Lenz, Schumacher and Clark, 1991) and the Strategic Content Learning, or SCL, approach (Butler and Winne, 1995). The SIM is an eight- stage instructional process that guides a learner to mastery of learning strategies. The instruction is direct and explicit with multiple reinforcement (or practice) strategies embedded. The development of these enables the learners to select and apply the most appropriate strategies for them to different learning situations to assist in the completion of the presented learning task. SCL is a strategic learning approach that is very similar to SIM as within this, proposed models are also used to assist self-regulation in learning.

These two methods share the goal of teaching cognitive processes that underlie successful performance, rather than focusing upon the quality of the task products alone (Borkowski, Muthukrishran and Harris, 1992; Ellis, 1993; Englert, 1992; Palincsar and Brown, 1994).

With SCL, a learner can transfer strategies across tasks once they have mastered them, e.g. a strategy developed for writing notes in a particular format can be transferred into note-taking approaches in lectures and other learning sessions. Another example of this could be the development of a strategy for reading that assists the learners in focusing upon specific language features or styles of writing, known as its register (Crystal, 1997). For example, following an argument in a piece of writing (and the language associated with this) can make it easier to comprehend lectures of this nature where the information is delivered orally (Ellis, 1993). A further example is the development of instructed reading strategies, which have been proven to help some individuals in independent paragraph writing. SCL is a form of intervention that can be useful in developing transferable reading and writing skills, with the necessary direction being given.

The internalisation learning of strategies that will enable learners to engage in the cyclical and reflective processes that define self-regulated learning (Wong, 1992) and that help learners to: 'Generate strategies designed to achieve specific and personally meaningful goals' (Wong, 1992, p. 187) must be beneficial to the promotion of learning.

In order for learning and study approaches such as the SCL and SIM to be utilised by learners, dyslexic or otherwise, the strategies have to be learnt via input from a third party such as a such as a tutor, peer or mentor. Research has also shown (Allsopp, Alvarez, Hatton and Farmer, 2010; Stampoltzis, Antonopoulou, Zenakou and Kouvava, 2010) that understanding the individual learning needs of an adult learner with dyslexia is central to assisting in the promotion of learning. Therefore, designing the delivery of any learning in such a manner as to facilitate inclusion and therefore promote learning

should be the desired aim. Further to this, Morgan and Klein (2000) and Mortimore (2003) suggest that adult students with dyslexia experience more difficulty in retaining and using information from the usual learning situations such as lectures and seminars. They suggest that a range of techniques that use the four modalities for learning (seeing, saying, hearing and feeling) should be built into any programme designed to promote learning strategy approaches. This would be needed to enable the adult learner with dyslexia to gain comparable access to the learning approaches required for use of either SCL or SIM. To put this another way, when teaching the development of holistic relational instructional strategies to promote access to and independence in learning for dyslexic adults, being able to successfully internalise, learn and then independently use any of these strategies relies on them being taught in an accessible way in the first place.

To explore this further, if we take dyslexia to be a specific learning preference rather than a developmental disorder (Morgan and Klein, 2000), the evidence suggests that 50% of learners with dyslexia will favour the kinaesthetic (feeling and saying) approach to learning and prefer deep approaches to learning over surface approaches. This means that the traditional chalk-and-talk (hearing and seeing) approach will not be as successful as one that considers multi-modal delivery. Another consideration is the view that interventions work best when they take into account the context (or course-specific content) of the area of study and that the materials used in any method of strategic learning strategy are most effective in helping students learn if they are discipline specific. In addition to this, as indicated in the literature review outcomes discussed previously (Hock, 2012) learners with dyslexia often have a different approach to study from their peers demonstrating a preference in strategies associated with deep learning. Biggs (2003) describes a deep approach to learning as a vigorous and critical engagement with learning materials, one that relates ideas to previous knowledge and that examines the logic of arguments in order to relate the conclusions to the evidence, and generally by endeavouring to understand materials for themselves.

This implies that learners with dyslexia will not learn well if they are in a situation that requires surface approaches to learning. Biggs (2003) explains that a surface approach to learning tends to concentrate purely upon assessment requirements, routine fact memorisation, and the ignoring of guiding principles and patterns. Surface learning also fails to reflect on any underlying purpose to learning other than memorising content. If the requirement is for the regurgitation of facts without understanding, such as citing back a formula, or remembering historical dates, then this approach can be effective for learning in general.

Having said this, any specific teaching of strategic approaches to learning for adults with dyslexia (outside the normal attendance to lectures seminars, etc.) is likely to have some positive outcomes in the classroom as a result of skills transferability.

In summary, for adults with dyslexia, learning and teaching activities that draw together multi-modal learning and directed time for reflection, assimilation and action, such as the pause procedures (Ruhl et al., 1990, 1995) can support access to learning if they are delivered in an appropriate manner. In addition to this, instructional learning strategies for problem solving (such as those evaluated in the Zawaiza and Gerber (1993) study) used alongside strategies that support the dyslexic adult's preference for deep learning approaches such as SCL and SIM when combined in a way that provides a more holistic learning experience, will improve access to learning for learners' specific learning difficulties such as dyslexia, and may also benefit other learners.

Summary findings from the instructional techniques discussion are that:

- Approaches to teaching that have a holistic, multi-strategy approach can enhance the performance of dyslexic adults in certain areas of learning.

- Explicit instruction continues to be a practice supported by research that is useful to the promotion of learning for those both with and without a specific learning difficulty such as dyslexia.

- Learning is promoted for adults with dyslexia if the deconstructing and the co-constructing of the strategies and routines that make learning more effective for them are utilised.

Teaching, learning and inclusive practice: key findings

The key significant findings in relation to theme 1 are as follows:

  i.   Use of a pause procedure in lectures may help to promote learning for all participants, including those with specific learning difficulties such as dyslexia. The pause procedure seems to enable all learners to assimilate content more effectively than with no pause, and improves, with a significant measurable effect, immediate free recall (IFR), percentage of correct responses and the content and quality of note-taking.

 ii.   The provision of handouts or outline notes in lectures does not benefit learning.

iii.   Approaches to teaching that have a holistic, multi-strategy approach may enhance the performance of dyslexic adults in certain areas of learning. This includes strategies that utilise a range of learning modalities and provide opportunities for deep approaches to learning.

iv.   Explicit instruction continues to be a practice which is useful to the promotion of learning for those both with and without a specific learning difficulty such as dyslexia. Teachers can improve students' learning of skills, strategies and content by providing clear explanation of content, skills, learning routines and strategies 'up front' and by modelling the cognitive and metacognitive behaviours associated with learning.

 v.   Learning is promoted for adults with dyslexia if the deconstructing and the co-constructing of the strategies and routines that make learning more effective for them

are utilised. In other words, if they are taught how to use the learning strategies that work for them as a transferable skill across a range of contexts, they can adapt their approaches to learning and problem solving accordingly.

vi. Engaging students in extensive proximal and distal learning activities that include both guided and independent learning promotes learning, but only if the instruction associated with this is appropriate and clear.

4.5.3 Study skills support and additional learning support: results and discussion

The additional learning support and study skills support findings discussed here are from two differing perspectives: firstly, as a range of activities completed outside the classroom environment to develop the skills associated with programme learning tasks, and secondly, as a set of skills developed with the potential to be transferred into a classroom situation, such as a seminar or lecture, with the view that these developed skills support access to learning. The summaries of these studies are in Table 15.

Table 15: Demonstrating studies within the emergent theme of study skills support and additional learning support

Study details	Study focus	Design and methodology	Findings
Guyer, B. P. and Sabatino, D. (1989). *The effectiveness of a multisensory alphabetic phonetic approach with college students who are learning disabled*	This study focused upon the use of structured language programmes to promote reading improvement delivered via multi-sensory teaching and learning methods as additional learning support.	RCT. The study compared three groups of 10 participants. All participants were diagnosed as dyslexic. All participants were pre-tested using the Wide Range Achievement (WRAT-R) and the Woodcock Reading Mastery Test (WRMT). Group 2 received the structured language programme (a modified Orton-Gillingham) using multi-sensory phonic remediation (the treatment group). This was delivered by appropriately trained specialists. Group 3 received a language programme which was non-phonetic (comparison group) and group 1 (the control group) received no interventions. A repeated measures ANCOVA was performed. For the ANCOVA, the IV was the type of intervention procedure, and the covariate was the IQ scores of the participants. The DV was the post-test scores in both the Wide Range Achievement (WRAT-R) and the Woodcock Reading Mastery Test (WRMT). Moderate quality.	The repeated measures ANCOVA demonstrated, 'A significant difference between the pre-test and post-test scores for the WRAT R ($F(1,57) = 12.76$, $p < .001$) and a significant interaction between groups and subtests ($F(2,57) = 10.24$, $p. <.0005$).' There was a significant main effect for the test factor ($F(1,57) = 15.12$, $p < .0006$) demonstrating significant differences between the pre and post-test scores on the WRMT. The interaction between the groups was also significant ($F(2,57) = 4.17$, $p <.0264$). The interaction results demonstrated a differential response on the repeated measures.' (p. 432) The Turkey HSD Test was used to determine in which groups a significant difference between pre- and post-test measures existed. The outcomes of this supported the hypothesis that college students with LD will make significantly more progress in reading when an adaptation of the Orton-Gillingham (O-G) is used, rather than a non-phonetic approach or no intervention.' (p. 432) The conclusions drawn was that the multi-sensory phonic intervention improved group 2's reading achievement, and that this technique was significantly more effective than a non-phonetic technique or no remediation.
Guyer, B. P., Banks, S. and Guyer, K. (1993). *Spelling improvement for college students who are dyslexic*	This study focused upon the use of structured language programmes to promote spelling improvement delivered via multi-sensory teaching and learning methods as additional learning support.	Combined RCT and QED. The study compared three groups of 10 participants. All participants were diagnosed as dyslexic. All participants were pre-tested using the Wide Range Achievement (WRAT-R). The use of the Wilson Reading System (a modified Orton-Gillingham) was used to teach spelling for group 2 (the treatment group); this was delivered by appropriately trained specialists. Group 1 had no intervention and group 3 had a non-phonetic spelling programme called Spelling Power (comparison group). An ANCOVA was performed on the three groups and unadjusted means for the three groups were determined. For the ANCOVA the IV was the type of intervention procedure, the covariate was the pretest-scores and the DV was the post-test scores (testing of spelling performance using the WRAT-R). Moderate quality.	'The ANCOVA showed significant group differences between the intervention procedures ($F = 87.11$, $p. < .0001$) (p.190). By using a post hoc multiple comparison procedure (Fisher) the significant differences were accounted for by group 2 who had received the multi-sensory phonetic technique. There was no statistically significant progress in groups 1 (control) and 3 (non-phonetic remediation).' (p. 191). The conclusions drawn was that the multi-sensory phonic intervention improved group 2's spelling achievement and that this technique was significantly more effective than non-phonetic or no remediation.

Study details	Study focus	Study design and methodology	Findings
Osborne, P. (1999). *Pilot study to investigate the performance of dyslexic students in written assessments*	This study focused upon the performance of dyslexic students in written coursework and examination assessments.	QED 38 dyslexic students were the treatment group and 38 non-dyslexic students were used as the control. This was a comparative study as both groups engaged in all of the coursework and examination assessment tasks. Moderate quality.	This study used a 'two-tailed test to establish the difference between examination and coursework performance for two groups of dyslexic and non-dyslexic learners. The results of this indicated that the difference between those without dyslexia and those with dyslexia in examination performance was significant, a 0.2% level of confidence.' (p.158) The dyslexic group also performed less well in coursework, but this was not statistically significant. As the dyslexic participants scored less well in both areas of coursework assessment and examinations, their overall results were, on average, poorer.

Structured language programmes

The studies within this theme focus upon the use of structured language programmes and multi-sensory approaches to learning and teaching for reading (Guyer and Sabatino, 1989) and spelling (Guyer, Banks and Guyer, 1993). The Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) studies are very similar in their design and so the outcomes of the quality evaluations for both are the same. The 1989 study is of QED and the 1993 study is also of QED along with a randomised controlled aspect. Internal validity for both studies is moderate–low as neither of the studies stated the use of blinded randomisation or follow-up. The design of the 1993 study is fractionally more rigorous as it had a randomised aspect; however, this did not impact upon the overall quality judgement. In both the Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) studies, there was a control group (no intervention), a treatment group (the group that received the phonic multi-sensory intervention) and an additional comparison group (a group that received an intervention that was not phonic or multi-sensory). The outcomes tested were improvement in accuracy of reading and spelling. The studies were of low external validity as the sample sizes were small (three groups of 10 different learners in each study). The relevance of both studies to the systematic review is high, as they focus upon phonic-based multi-sensory methods of teaching reading and spelling. These approaches have a significant track record of success (Torgesen, 2002) and the studies are focused upon learners in HE (college students in the USA). The evidence from the Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) studies concluded that access to the phonic multi-sensory structured language programmes (which were here delivered as additional learning support) led to a significant improvement in reading ($F(1,57) = 12.76$, $p < .001$) and spelling ($F = 87.11$, $p < .0001$). This raises a number of considerations. Advocates in the field, such as the British Dyslexia Association (2017), Dyslexia Action (2017a) and the International Dyslexia Association (2017) have recognised the value of these phonic, multi-sensory structured language programmes for children and adults alike for a number of years, which begs the question of whether the FE and HE institutions in England also recognise their potential value. This is not a question this systematic review can answer. What can be

discussed on the evidence of the literature review is that it is clear that for effective delivery of phonic, multi-sensory programmes, tutors need to be trained to understand the concept of multi-sensory teaching and learning and who have practical know-how of how this should be delivered to achieve the best learning outcomes. To put it another way, the practitioners need to be skilled in taking the principles of multi-sensory teaching and applying them at a practical level to support measurable improvement in the learners. Mellard (2008) goes so far as to suggest that specific learning difficulty status is one that: 'should be considered as a relevant variable in adult education that warrants a diagnostic or clinical teaching approach' that, 'focuses upon very specific skills and considerations of the cognitive processes associated with the specific learning difficulty condition such as phonemic awareness, memory and executive functioning.' (Mellard, 2008, p. 143), and in addition, that part of this process will be to advise and train the learner to be self-aware in their learning and to provide practical learning strategies for the learners that they can adopt and apply to a range of learning contexts. This is not a straightforward process for the 'common or garden' tutor or lecturer to embed into their practice, and arguably this is not part of the tutors'/lecturers' general teaching role.

This is really the role of a specially trained additional support tutor who will be able to assess for and select an appropriate structured language programme for the individual learner. They will be able to develop a syllabus or curriculum based on the learner's individual skills profile and develop the resources required to support the delivery of the planned programme to the learner. The specialist tutor will also make efforts to understand, to a reasonable extent, the academic skills discipline (including specialist language spellings and meanings) the student is studying as it has been shown that contextually relevant materials are more likely to support learning success. This is because they effectively support discipline-level knowledge transfer and maintain relevance for the learner (Basic Skills Agency, 2002). All of these intricacies of planning and delivery are advisable if a tutor is intent on supporting the spelling acquisition of academic or vocationally relevant language through a multi-sensory spelling programme (Lee, 2002) in addition to any structured language programme.

The combined evidence related to the use of structured multi-sensory teaching and multi-sensory learning for reading and spelling improvement and the instructional strategies associated with this will develop the underlying skills proven to support language and literacy development, such as short-term memory capacity and sequencing (Lee, 2002) and skill automaticity (Fawcett and Nicolson, 1999, 2001), which in turn must benefit general learning. This is due to the repetitive nature of the teaching and associated learning drills that offer continual reinforcement (Dyslexia Action, 2017a; British Dyslexia Association, 2017; Lee, 2002). Other less recent research and practice also suggested that this was the case (Walker and Brooks, 1998). Attention to these types of skills deficits, as well as focusing upon developing the skills needed for reading and spelling via structured language programmes, will improve the reading and writing performance of those with dyslexia where conventional methods have been less successful (Hornsby, 2005; Lee, 2002; Dyslexia Action, 2017a; British Dyslexia Association, 2017).

Summary findings from the structured language programmes discussion are that:

- A multisensory structured learning programme can promote improvement in reading and spelling, but this should be fit for purpose and delivered by specially trained and appropriately qualified staff.

Multi-modal teaching and learning strategies

Multi-sensory teaching approaches and learning strategies are part and parcel of the delivery of any multi-sensory structured language programme designed for those with dyslexia. However, these programmes are delivered as additional learning support, usually in a one-to-one situation with a specialist tutor or mentor, when they are available. Clearly, the principles of multi-sensory (or multi-modal) learning are better suited to the one-to-one and/or small-group situation, where it is more applicable from a pragmatic perspective than to a mass delivery situation such as a lecture. It is hard

to disagree with this, but examples such as the pause procedure (Ruhl et al., 1990, 1995) that have had some success and that attempt to support multi-modal and multi-sensory learning (or engage the visual, auditory, verbal and kinaesthetic channels by building in activities that enable, seeing, saying, hearing and doing to happen in as simultaneous a way as possible) demonstrate that it is possible with careful planning. To put it another way, multi-modal, interactive, kinaesthetic and sensory teaching and learning approaches could be used more frequently in lecturing situations, if the additional planning to do this was seen to be worthwhile. Additionally, sessions do not need to be as structured and planned as in the pause procedure (Ruhl et al., 1990, 1995), the structured phonic multi-sensory language programmes (Guyer and Sabatino, 1989; Guyer, Banks and Guyer, 1993) or the instructional techniques explored (Zawaiza and Gerber, 1993). The use of visual prompts, auditory prompts, verbal instruction, kinaesthetic prompts and concept teaching can draw together logic and patterns if delivered with sound instructional approaches that integrate the elements of a problem to be solved into a coherent whole (Lewis, 1988; Moroz, 1978). This type of thinking in those planning and delivering lectures could be encouraged. Activities that include listening and repeating back (such as in the pause procedure or the Think Aloud Procedure discussed previously) could be established in everyday classroom practice. A combination of these approaches could encompass all the learning channels to a lesser or greater extent and increase the opportunities for knowledge to be assimilated.

Whilst some of the general principles of multi-modal and multi-sensory teaching and learning could be developed in delivery should the desire be there, the greater challenge would be the cultural change required for the successful planning and delivery of learning and teaching that would be necessary. Curricular innovations of this nature would be viewed as a radical change to existing teaching practice in HE by some. Further to this, if the willingness to engage in staff development were there to support some skill development in this area, it could be a significant resource cost, depending upon the extent of the training desired and the scope of specialist skills to be developed.

The counter argument to pursuing any radical changes to classroom teaching practice is the 'reasonable adjustments' (Equality Act 2010; HM Government, 2010) argument. Reasonable adjustments are required by law and are usually formed as a set of 'instructions' (or the minimum requirements for support expected to be met by tutors and lecturers) as outlined in a learner's dyslexia assessment report. Examples of reasonable adjustments are the provision of the lecture information a week in advance, handouts that use specified coloured paper and typefaces and/or allowing voice recording in lectures. If these steps are implemented by a lecturer or tutor, it could be argued that they are adapting the learning environment to make it more accessible and are being as inclusive as required in their current practices. From this perspective, it could be argued that the most appropriate place for the provision of extra support, over and above these 'reasonable adjustments', should rightfully be in the form of additional learning support or study skills support. For those with dyslexia, building in one-to-one session time with a specialist dyslexia tutor immediately following a lecture or seminar, in the form of additional learning support, is likely to be a more acceptable option to the lecturer/tutor than any radical change to their approaches to delivery.

Summary findings from the multi-sensory approach discussion are that:

- Teaching approaches that utilise the multi-sensory strategy (see, hear, say, do) and are discipline specific can, if used appropriately, support more effective learning.

Coursework and examination assessment performance

Osborne's (1999) study discussed the effects of dyslexia on coursework completion and on time-bound exam performance. The participants were 38 dyslexic university students and 38 of their non-dyslexic peers who were randomly selected from the student population (as the control group). This study, designed more so to reflect a natural experiment which compares performance on the

alternatives of coursework and exams. This study established that the dyslexic group performed less well in both the areas of coursework assessment and time-bound examinations, but that the difference was much greater in examinations, where there was a difference of statistical significance. It also suggested that overall, with a combined diet of assessments such as this, the learners with dyslexia would still perform, on average, more poorly. Although the difference in performance for coursework assessment was not statistically significant, it was still poorer. The study compared between group and not individual performance. It did not use random allocation, blinding or indicate any secondary outcomes or measures for these. It used comparison as a way of measuring progress between groups and also used two-tailed tests to establish confidence intervals. The sample of 76 participants is not large enough for any confidence in the findings to be established. Therefore, the internal validity was judged to be low. External validity and relevance were also judged as low. The study was of low relevance to the systematic review as it focused upon adaptations to assessment methods rather than learning and teaching adaptations per se, but it can be linked to the broader role of additional learning support and study skills support, which is a focus of this systematic review.

Given the pattern of learning difficulties associated with dyslexia in adult learners, the production of ongoing coursework appears to be better suited to them as an assessment strategy as it enables learning to be demonstrated over an extended period of time and in a less pressured situation such as an examination.

The main issue, according to Osborne (1999), for adult learners with dyslexia, is time-bound pressure in exams. Research by Carroll and Iles (2006) and Tsovili (2004) has shown that anxiety related to coursework assessment is state–trait in a number of adults with dyslexia. This general anxiety increases when forced into examination situations and significantly affects performance. It is believed that this dip in performance happens as the difficulties associated with dyslexia are exacerbated by pressured situations.

The pattern of deficits that help to identify dyslexia, such as a slower reading speed, comprehension issues, poor phonological, or letter–sound awareness (Snowling, 2000), over-reliance on contextual and syntactic clues, poor automatic memory (Fawcett and Nicolson, 2001) and limited short-term memory (Lee, 2002), when coupled with high anxiety, will all disadvantage the dyslexic adult in an examination situation. This is recognised in current HE assessment practice, as students with a formal diagnosis of dyslexia can be and often are provided with 'appropriate interventions' such as an amanuensis and/or reader to support them through the examination, if there is evidence that these adjustments are required. These are used in an effort to limit the pressure associated with reading and composition in an examination situation for these adults. Some additional interventions can also be provided if this is indicated as required in a formal assessment report (Powell and Tummons, 2011). For example, resources provided that have ICT assistance, such as a laptop, or other AT and/or software packages that have proven useful in a learning situation and can also be beneficial in an examination situation. This approach should be treated with some caution as the technical skill of using any type of supportive equipment in a high-pressure situation, such as an examination, may not have the same positive impact that it has been seen to have within less pressured study situations.

In the context of assessment practice in HEIs, there is an expectation that examinations will form a part of the overall assessment diet in a 'good-quality' programme. Also, the requirements of some professional bodies stipulate that examinations must be part of the assessment strategy to secure professional endorsement (Quality Assurance Agency for Higher Education, 2017). Given this, it is likely that learners with dyslexia will be placed in an examination situation at some point to test their learning. From this perspective, it can be argued that HEIs have the responsibility of 'levelling the playing field' by providing useful and appropriate interventions and concessions that will give the dyslexic adult an equal chance of demonstrating his or her knowledge. As each learner with dyslexia will have a pattern of deficits that are different (within the syndrome), a one-size solution will not fit all. Some types of exam concessions do not always provide the 'right intervention'; for example extra

time may be of little use if exam stress is an issue. If processing speed, spelling accuracy and the ability to formulate well-structured and focused answers to examination questions are also issues, then this will become worse in time-bound, pressured situations. A reader or amanuensis may help with the reading and writing tasks, but this is often a stranger who will not fully understand the individual requirements of the learner. This could negate any positive impact of having someone available to assist in the technical skills of reading and writing. It could be suggested that expecting a learner with dyslexia to sit examinations at all is placing them at a significant disadvantage to their peers, and that this 'high-pressure' form of assessment should not be part of the assessment strategy for a learner with these types of learning disabilities. If a move away from examinations as part of the assessment regime for adults with dyslexia were to be embedded into policy and practice, it raises other considerations. For example, some vocations rely upon the ability of an employee to work accurately in situations of high pressure and to have the skills sets and knowledge to be able to act appropriately and quickly: nursing is one such profession, for example. It could be argued that examinations perform this role to some extent and that success in examinations demonstrates the ability to function well under pressure, which will be a notable positive when applying to move into some careers. However, in professions where the requirements of the HEI and the Quality Assurance Agency for Higher Education can be met without the use of exams, it is both acceptable and appropriate to explore other assessment methods as an option. Examples of this could be via portfolio, presentation, written reports and so on (Attwell and Hughes, 2010). The removal of exams from the assessment strategy for adult learners with dyslexia may be seen to be addressing, at least to some extent, equal and fair access to the assessment process (Special Educational Needs and Disability Act 1992; Equality Act 2010). Where examinations are strictly necessary, then the way these are formulated and facilitated should be carefully planned so as to not disadvantage the adult learner with dyslexia as far as is achievable.

In summary, if we take the theme of additional learning support and study skills support alongside the findings from the studies evaluated under this theme within the systematic review, it appears that the content and delivery of effective additional learning support and study skills programmes will need to be different for adults with dyslexia if they are to be successful. Additional learning support packages may need to be designed in a way that uses structured approaches to learning, and that encourage the use of multi-sensory learning (and teaching). It should endeavour to make learning tasks 'multi-modal', thus drawing on both language-based and non-language-based skills (Morgan and Klein, 2000) if learning is to be as inclusive as possible. If it is the desire to use additional learning support and study skills packages to assist the dyslexic learner in knowledge and skills development that promotes equitable access to their HE curriculum, then practitioners, lecturers, support workers, student support units and HE managers need to consider whether their existing practices are fit for purpose in order to make this as achievable. With regard to assessment and examinations, each learner learns differently and it can be argued that all have a right to be provided with the opportunity to show their learning in a way that is fair and equitable, which means access to appropriate assessment regimes (Equality Act 2010). If, for the adult with dyslexia, this means alternatives to examinations, then this is an aspect of assessment practice that should be explored and developed where practicable.

It was not the aim of this systematic review to establish what is currently happening within the HEIs themselves. Its purpose was to evaluate any interventions in use for the provision of additional learning support and study skills availability for adults with dyslexia in HE generally and to highlight any activities that are useful. However, if any of the interventions are viewed by managers and policy makers in HE as a way to improve the overall experience for adult learners with dyslexia, then this could be an area of development to enhance learning. Pragmatically, there may be some issues that prevent these support activities becoming a reality on a large scale. The cost implications associated with training dyslexia tutors in the techniques and materials associated with multi-sensory teaching and learning strategies would be significant, and the employment of additional staff who are already

trained in these techniques may not be viewed as cost effective, given the proportion of learners with a diagnosis of dyslexia currently accessing HE. Then there is the issue of the students themselves. Even if this specialist service were readily available, uptake of these additional activities may still be challenging. Some students may bypass these additional opportunities if they are happy with their performance, have exam concessions in place and are not concerned about grades. Time constraints could also be an issue for some of the learners; additional support would be an additional pull on their time. However, if this type of specialist additional support were to be readily available outside the classroom and provided by an appropriate other such as a mentor or tutor, along with attendance to scheduled lectures and seminars being encouraged, issues regarding fuller access to the curriculum may not be as pivotal. To put it another way, if the additional support sessions are planned and delivered effectively and the content is discipline specific, this may help to support the achievement of the deep and sustained learning outcomes desired.

Summary findings from the coursework assessment and examinations discussion are that:

- Coursework-type assessments appear to be better than exams in promoting fairness and enabling dyslexic learners to be given the opportunity to demonstrate their learning in as equitable a manner as possible.

Study skills and additional learning support: key findings

i. A multi-sensory structured learning programme may improve reading and spelling, but it should be fit for purpose and delivered by specially trained and appropriately qualified staff.

ii. Teaching approaches that utilise the multi-sensory strategy (see, hear, say, do) and are discipline specific can, if used appropriately, support learning.

iii.   Coursework-type assessments appear to be better than exams in promoting fairness and

enabling dyslexic learners to be given the opportunity to demonstrate their learning in as

equitable a manner as possible.

4.5.4 Information communications technology and assistive technology: results and discussion

ICT and AT could not be separated from either 'inclusive approaches to teaching and learning' or 'study

skills and additional support' within the studies in this systematic review. ICT and AT were either

discussed as an aid to support learning in lectures/seminars or as part of an additional learning support

or study skills intervention. Therefore, it emerged as a sub theme of the other two themes. There were

two studies that were identified as best fitting within this sub theme and the summary data for these

is presented in Table 16.

Table 16: Demonstrating studies within the emergent sub theme of ICT and AT

Study details	Study focus	Design and methodology	Findings
McNaughton, D., Hughes, C. and Clark, K. (1997). *The effect of five proofreading conditions on the spelling performance of college students with learning disabilities.*	This study evaluated whether five different proof-reading conditions were influenced by the use and non-use of assistive technology to assist dyslexic students to proof-read and correct their own spelling errors.	QED. Twelve participants were in the sample. All were exposed to the five interventions which were: handwriting with no additional assistance; handwriting with a conventional print dictionary; handwriting with a handheld spelling checker; word-processing with no additional assistance and word-processing with an integrated spell checker. These five conditions were tested with one-week non-intervention time between the intervention periods to minimise interference effects across the conditions. The outcome measures (DVs) were 1. Errors in the original draft; 2. detection of spelling errors; 3. correction of spelling errors; 4. errors in the final text; 5. time for detection of errors and 6. participant preferences. Moderate quality.	The comparison was between the five conditions and the individual performances of the learners within these conditions, hence the detail outlined below. 'High levels of spelling errors in first condition' (no assistance). No significant differences between the conditions were detected.' Detection of spelling errors differed for the five conditions, and the word-processor with spell checker condition provided a statistically significant advantage (69.3% errors detected) over the other four conditions: writing (40.1%,) handwriting with print dictionary (35.9%); handwriting with spell checker (42.1%) and word-processing (44.3%). $p. < .05.$' (p. 646). 'Statistically significant differences in the proportion of detected and corrected errors were observed. Word-processer with spell checker (mean proportion of errors corrected = 81.9%) had a statistically significant advantage over both of the unaided conditions, followed by handwriting with a spell checker ((76.1%) then handwriting with a print dictionary (65.9%) then word-processing (51.1%) then handwriting (36.1%). $p. < .05.$' 'In four of the five conditions the detection and correction activities had a significant effect on the number of spelling errors in the final text. Significant advantage from use of word-processor with spell checker (3.3%), Handwriting with a spell checker (4.9%), Handwriting with a print dictionary (5.9%), word-processing (6.7%) and handwriting (7.1%). $p. < .05.$' (p. 647). 'Statistically significant differences in the total time needed to detect and correct errors were observed for all five conditions. Handwriting with print dictionary took significantly more time than the other four conditions (mean time 12 min 47 secs). Handwriting 6 mins 16 secs, handwriting with spell checker (hand held) 8 mins 22 secs, word-processing 5 mins 4 secs and word-processing with spell checker 5 mins 51 secs. Handwriting with a print dictionary was significant slower that word-processing with or without a spell checker.' (pp. 647–648) 'Participant Preferences: Ranked by participants in order of preference for future use. Word-processing with spell checker significant statistical advantage over the other four conditions (8 out of 12 selected this as first preference) $p. < .0001.$' (p. 648).
Taylor, M., Duffy, S. and Hughes, G. (2007). *The use of animation in higher education to support students with dyslexia*	This was a comparative study that tested the effectiveness of animated and non-animated slides upon learning across a range of concepts.	QED. The sample was 13 'self-declared' dyslexic students and 13 non-dyslexic students. All participants received the intervention. Academic profiles of all participants were similar. The intervention is a set of animated slides, and the comparison is the same students' performance against a set of non-animated slides. The outcome measures were performance in response to nine questions to establish how well compared to each other the animated versus the non-animated slides assisted them in developing their understanding across the topics (p.290). Confounding variables were not managed effectively. Low quality	'Tallies of scores were subjected to the chi-square test of the null hypothesis. Results: 1. There was a low probability of the given questions being answered at random. 2. Very few questions (6 out of 234) gave a score of less than 5% on the 1–10 answer scale. 3. Both groups appeared to consider the animated learning materials as being more useful than the static versions. 4. Speed of understanding the concepts presented was higher for the control group than the dyslexic group ((8.38, 7.23) p < 0.01). 5. The understanding of symbols and diagrams was rated the least useful aspect by the dyslexic group as opposed to the control group who found it one of the most useful aspects ((6.15, 8.38) p < 0.001). 6. Within the material content, both groups of students stated that the animated materials assisted their understanding of the concept of data flow ((7.00, 8.46 p < 0.001). 7. Both groups of students viewed the animated learning materials as being 'roughly equal' in assisting in overall understanding of concepts, interaction of concepts and application of concepts in practice ((7.23, 8.23) p < 0.001; (7.46, 8.08) p <0.05; (7.62, 8.08) p < 0.001) respectively). 8. Both groups viewed the usefulness of the animated learning materials for the concept of levelling as being lower than that of the other animated learning materials ((6.77, 7.69) p < 0.01).' (pp. 32–33). All of the participants appeared to consider the animated learning materials as being more useful than the static (or non-animated) versions.

Proof-reading techniques

The McNaughton, Hughes and Clark (1997) study encompassed both study skills and the use of ICT and AT. It evaluated the impact of five different proof-reading conditions on identifying and correcting spelling errors, which the learners completed independently over a period of weeks. The internal validity was low, all participants received the intervention and therefore there was no randomisation or blinding, precision of effect size was estimated, and the experiment was carried out with close supervision of each individual participant. The participants were carefully selected and identified formally as learning disabled (based upon the discrepancy model). The external validity is low, as the sample size was small, was based on one class and was implemented by the tutor. Relevance was high as the study evaluated five conditions using AT to establish the impact of these on spelling accuracy, error detection and correction. A number of these interventions could be used in the lecture/seminar or independently to support assignment work and general study skills development. The overall rigour judgement for this study was low. This study concluded that word-processing with a spell checker provides an advantage over most other proof-reading and correction techniques with respect to effectiveness, efficiency and acceptability to students, though this cannot be verified by such a poor quality study, some of the findings were interesting and useful to this systematic review though treated with caution. Given the broader issues of comprehension, speed of information processing and automaticity in adults with dyslexia, discussed previously (Lee, 2002; Fawcett and Nicolson, 1999) and as evident in the definitions of dyslexia in the literature review (British Dyslexia Association, 2017; Dyslexia Action, 2017a), the word-processor with spell checker is an intervention could be particularly useful for writing and correcting errors without the assistance and input of others. For independent study that is constrained by external pressures for speed, and improved accuracy, a word-processor with this function is a viable study support intervention option. This type of AT may also assist with accurate note-taking in a lecture and/or seminar situation. It is true that adults with dyslexia often cannot read the handwritten notes they have made because they are disorganised, full of errors and often messy (Reid and Peer, 2003; Fawcett and Nicolson, 1999). The use of a word-processor and spell

checker in as many learning situations as is feasible may provide increased access to learning for the adult learner with dyslexia. The use of this type of technology may improve the accuracy of the information recorded and therefore the learner will have a greater chance of making sense of the text after time has passed. In conclusion, certain types of ICT and AT can provide measurable benefits for those with dyslexia and may be a useful addition to the other strategies and tools available.

Summary findings from the proof-reading techniques discussion are that:

- The use of a word-processor with a spell checker may improve the accuracy of recording information and is the most acceptable to students with a specific learning difficulty even compared to hand-held dictionaries and other assistive spelling resources.

Use of animation

The Taylor, Duffy and Hughes (2007) study evaluated the intervention of both animated and non-animated slides in order to establish whether either of these two conditions impacted upon the learning of a range of concepts delivered in a sequence of learning sessions. This study was assessed as having low quality due to internal validity issues. The 'self-declaration' of dyslexia for the learning-disabled half of the sample is a major concern. This cannot be acceptable as a valid identification of learning difficulties. From this viewpoint, the experiment was based upon a flawed assessment of the participants' pre-condition. Also, the way in which the intervention was administered was questionable. Implementation fidelity was not effectively managed, and therefore any claim of demonstrable significant effect was judged as low due to the potential disruption from nuisance variables, its internal validity was low. Its external validity was also low: the sample size was small and as explained above, there were quality issues with the selection of the sample. Its relevance was high, as it was an evaluation of an intervention delivered in HE lectures that used animated and non-animated slides to establish whether they affected learning for the dyslexic and non-dyslexic

participants and what these effects were. This is directly related to the theme of teaching, learning and inclusive practice as the curricular modification was used in an effort to enhance access to the materials and improve learning opportunities. Overall, the rigour of this study was judged to be low.

The outcomes of this study indicated that the participants considered the animated learning materials to be more useful than the static (or non-animated) versions. The animated materials were better at promoting understanding for both the dyslexic and the control students than the non-animated ones, although the control students appeared to find them more useful than the dyslexic ones. If materials of both formats are presented to dyslexic students, it is suggested that it may still be more difficult for the students with dyslexia to access them. Non-dyslexic students will also typically find these and other forms of learning materials easier to access than those with dyslexia.

Although the Taylor, Duffy and Hughes (2007) study had mixed results and quality issues, there were still areas of interest highlighted that warranted further exploration.

It should still be acknowledged that the use of animated delivery methods reflects some of the principles and practice of multi-sensory teaching (and multi-sensory learning). From this perspective, the claimed improvement of access to learning when compared with the outcomes of the studies that focused upon multi-sensory delivery techniques, i.e. using a range of learning modalities in a synchronised manner, and the relative (though limited) success of using animated materials as opposed to non-animated materials claimed in the study, may be valid. This type of approach to delivering learning would not require any training in the delivery of multi-sensory techniques, but may need some professional development in the use of animated slides for content delivery. Arguably, this would be a less expensive and easier method that could be promoted in practice to help to support access to learning for the adult learner with developmental dyslexia.

Summary findings from the use of animation discussion are:

- The use of animation in lecture situations (which integrates aspects of multi-sensory learning and teaching) may promote learning for all learners and may be particularly beneficial to promote the learning of adult learners with dyslexia.

Information communications technology and assistive technology: key findings

   i. The use of a word-processor with a spell checker may improve the accuracy of recording information and is the most acceptable to students with a specific learning difficulty even compared with hand-held dictionaries and other assistive spelling resources.

  ii. The use of animation in lecture situations (which integrates aspects of multi-sensory learning and teaching) may promote learning for all learners and may be particularly beneficial to promote the learning of adult learners with dyslexia.

4.6 Conclusions and recommendations

It is not a straightforward process to identify exactly what works for learners with dyslexia and what does or does not promote effective learning. Research in the area is complex, and the individual nature of the patterns of learning difficulties associated with dyslexia tells us that there can never be a one-size-fits-all solution. However, if we consider the most persistent difficulties that students with dyslexia report: writing assignments and taking written exams, spelling difficulties, comprehension issues, memorising names and facts, note-taking difficulties, and difficulty in daily organisation and study skills (Gilroy and Miles, 1996; Mortimore and Crozier, 2006; Reid and Kirk, 2001; Singleton, 1999) and use these as an evidence base to inform practice, alongside what the single studies and the

literature review findings in this systematic review indicate, some cautious conclusions and recommendations can be made.

It can be tentatively deduced that here are a number of in-class (embedded) and out-of-class (additional) strategies that can be developed that will assist the dyslexic learner, and that the majority of these are also beneficial to learners who do not have learning difficulties.

With specific reference to in-class practice to promote inclusion in learning, a range of different strategies that could be adopted for both lecture and seminar situations. Some examples of adaptations that have been made where there have been measurable improvements claimed in the performances of dyslexic adults (as well as their non-dyslexic peers) have been tried in the papers included in this systematic review, for example, the use of animated lectures, the use of third-party 'facilitators' in lectures and seminars in small learning groups, and a 'pause procedure' in the delivery of information, particularly in lectures. ICT and assistive technologies, such as reading pens, voice recorders and laptops, may help to promote and support learning in a range of contexts and learning situations, as indicated in the literature review.

There are also the more complicated teaching and learning approaches that are less easy to operationalise and that may have a significant resource cost should they be used. These are the ones that utilise multi-sensory learning or multi-modal learning in the classroom; models of explicit instruction such as SCL and SIM or developing interactive resources, hands-on activities and other tactile opportunities for learning. These are all areas of practice adaptation that show promise but which require a much more robust testing process to confirm their effects.

Based on the evidence in this review, some of these more specialist approaches and strategies are not in common use in classroom practice in HE and that some of the more easily adoptable ones are not

being used as much as they could be. With delivery methods such as multi-sensory learning, this is unsurprising, given the complex nature of the required delivery methods and associated training.

However, an area that could be addressed relatively easily, should the desire be there, is, for example, pausing in the delivery of lectures to enable discussions and reflection to take place; this may be more successful with a trained peer (such as a teaching assistant or mentor who can structure and direct the discussion).

The process of pausing in lectures and discussing lecture content with a class peer has been shown to have some promise in assisting with learning. Both of these methods are useful for the learners with dyslexia as this provides opportunities to process learning and also to keep up with what is happening in the classroom rather than falling behind, which is likely to be the case if there is no time for reflection and the assimilation of new knowledge. However, much more robust research needs to be carried out to test the effects of the pause procedure if any changes to practise are to be recommended. The use of more holistic approaches to learning, for example, the frequent use of interactive learning materials such as animated slides and using diagramming and/or schematic approaches to teaching and learning, will enable concepts to be more readily joined up and understood. Hands-on, tactile learning such as models, the use of word-processors to note-take and recorders to record lectures etc. will assist the adult dyslexic learner with access to the curriculum. Providing clear and explicit instructions for in-class and out-of-classroom tasks is vital and could be addressed relatively easily with thoughtful planning of teaching activities and learning tasks and the willingness to do so.

However, having said all of this, it could be argued that these 'wholesale' adaptations to classroom practice are not necessary. If we consider the relatively few number of learners with dyslexia in a lecture or seminar at any one time, and in addition to this if they have additional support tailored to

their individual needs in place outside formal class contact time, radical adaptations to classroom practice, it can be argued, are not needed. This is a valid point; even though some of the studies demonstrate that all learners can improve their learning if some of the alternative delivery strategies described above are utilised, it cannot be said with any certainty that this evidence shows it is actually necessary.

In terms of additional learning support (which is provided outside the lecture/seminar classroom), programmes of support tailored and designed to suit the individual needs of the dyslexic adult learner could prove invaluable. Academic study skills can be developed via these 'packages' which have been seen, in some instances, to be transferrable into the lecture and seminar classroom successfully, thus supporting access to learning. This would remove any emphasis on the lecturer or tutor to make radical adaptations or changes to their existing classroom practice. This could also perhaps reduce the reliance on ICT and other assistive technologies in the classroom for some of the adult learners with dyslexia who would prefer not to be 'different' from their peers.

Examples of the types of additional learning support that can be delivered by an appropriately qualified specialist are: learning drills that are designed to increase short-term memory capacity, developing ways of adopting multi-sensory strategies to learn subject-specific complex spellings, and 'smart' ways of note-taking, for example, using colour, pictures, diagrams, codes etc. These methods can all assist the dyslexic adult learner to access learning, perhaps as readily as their non-disabled peers. For more severe dyslexia-associated problems, the delivery of structured language programmes outside the classroom with the use of multi-sensory teaching and learning strategies that use seeing, hearing, speaking and feeling simultaneously could be an option if the institution had appropriately qualified teachers. In addition to this, if the content of these programmes were related to the students' curriculum to assist with concept linkage and knowledge development, learning perhaps would also be more efficient. When thinking about assessment feedback, which can be seen as an

aspect of supporting learning, less emphasis on written feedback and more on audio or oral/discussion feedback would also be of benefit.

In the pockets of examples of research included in this systematic review, it would appear that work in the area of inclusive practice regarding supporting the full inclusion of learners with dyslexia is patchy. This is not helped by the fact that the studies included in the review are few in number, and most have both poor internal and external validity ratings as outlined in sections 4.3.4, 4.3.5, 4.3.6 and 4.3.7. This research indicates that there are some efforts to experiment with different approaches and methods to establish any adaptations that may be beneficial for students with dyslexia, and that some appear to be more successful than others. However, due to the weak evidence base, which is a result of the nature of the studies themselves (for example, small-scale QEDs as opposed to large scale RCTs), extreme caution was taken with any suggestion of claims to significant effects of the interventions evaluated.

In relation to the social models of disability and their application in practice reasonable adjustments (Equality Act 2010; HM Government, 2010) when being made may be enough to meet the requirements of the law for teaching and assessment/examination practice, but there is no clearly definable effective classroom practice model at all and none of the models in use stands out as being superior to another, as identified by the studies contained in this systematic review.

Also, as long as the additional learning support provided outside the classroom is appropriate and includes the development of transferable skills in the adult with dyslexia, and training to address specific issues such as short-term memory capacity is also included, it can be argued that their ability to access learning in the 'classroom' would automatically also improve. Therefore, some of the issues regarding the barriers to learning raised by an adult learner with dyslexia may be addressed via these methods. If wholesale training in specialist classroom delivery methods is something that is considered

to be a viable and realistic option (which seems unlikely to have mass take-up), then the cost implications could be significant.

Perhaps there is a middle ground in promoting some of the less specialised and less costly adaptations to practice that are outlined previously in this discussion. The vast majority of these could be delivered via short programmes of continuing professional development that are made available for staff who wish to develop both their awareness of inclusive teaching practices and resource development in an effort to make their teaching as accessible as possible to benefit all learners, rather than making it an issue about developmental dyslexia per se.

One theme that is emerging and that appears to be a significant gap in current practice is the effective and planned use of a third person to support access to learning, for example, 'a facilitator', 'a mentor' or 'a peer' who is able to work with adults with developmental dyslexia across a range of learning situations, when it is appropriate to do so.

There could be an argument to establish and evaluate the use and roles of mentors and teaching assistants (TAs) in HE generally. This is an area of support that was not mentioned in any specific way in the studies included in the systematic review. However, the use of a third person as a 'learning catalyst' in dyads and triads, in learning situations that use directed discussion, scaffolding and schematic delivery for learning task execution, was discussed. This appeared to provide some benefit for learners with specific learning difficulties or dyslexia. It is accepted that learners with more obvious learning disabilities such as a visual or hearing impairment are more likely than not to have assistance in all aspects of their learning, partially as a result of the Equality Act 2010 and related legislation, so why not for those with a hidden disability such as developmental dyslexia? The use of a 'third person' in an academic support role could enable the facilitation of better learning for adults with developmental dyslexia without lecturers or tutors needing to make significant adaptations to their

classroom practices and/or their resources. Perhaps all they would be required to do is communicate with the mentor and learner regularly, perhaps via tripartite tutorials, to establish that learning is going to plan, and to provide any additional input needed via this mechanism. The British Dyslexia Association (2017) established that adults with dyslexia in HE working with mentors both within and outside a classroom situation were helped to better understand their own learning needs and that the mentors also helped them to choose strategies that met these needs. If this were a policy and practice recommendation that were to be taken as a realistic and useful way forward, it would take a level of organisation outside the classroom that could fall to the central disability services of an institution rather than that of an individual tutor or lecturer. This approach to the provision of additional learning support would also need an institution to 'buy into' the recruitment and training of these mentors and the tracking of their activities. This intervention would provide opportunities for research to explore how beneficial the provision of appropriately trained mentors (as an intervention) may be in relation to any improved academic outputs of the individual. This would help to assist with the reduction of any gaps (real or perceived) in communication between the 'support service' and the 'academics' and put the learner at the centre of a holistic learning process.

Also, for a learner with developmental dyslexia that any underachievement in performance may be preferable to having obvious 'additional' support in the classroom. The use of 'hidden' smartphone applications and software packages on laptops and tablets may provide a more acceptable discrete 'third person' or interface that some students may be more comfortable with. The extent to which any of this could happen would depend upon the institutional policies and practices, the level of 'impairment' and the personal views of the learner.

Having a reasonable number of dyslexia-trained tutors to offer additional and appropriate support outside the classroom would seem to be a sensible option for HEIs. A more integrated approach, whilst maintaining the provision of one-to-one or small-group specialist support for the dyslexic learner as

'an additional aspect of their study or learning journey', such as that explored in the Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) papers, may be a useful way forward.

The extent of how, or if, specialist additional learning support such as this is provided across HEIs is not something that can be discussed here as it did not appear in any depth in any of the included studies.

In summary, the following conclusions were established:

- There are a range of teaching and learning strategies and activities that could be used to promote the learning of those with dyslexia. Some of these are:

  − approaches to teaching that have a holistic, multi-sensory and strategic approach

  − the use of explicit instruction, a practice that is useful to the promotion of learning, both for those with and without a specific learning difficulty such as dyslexia

  − the use of a pause procedure in lectures may help promote learning for all participants, including those with specific learning difficulties such as dyslexia

  − the use of animation in lecture situations, which may promote learning for all learners but is reported as being particularly beneficial for learners with dyslexia.

- Some types of ICT and AT, such as a word-processor with a spell checker, appears to provide increased access to learning for the adult learner with dyslexia.

- Training and development of staff in knowing and being able to use these methods (including some knowledge of the benefits and use of multi-sensory teaching and learning approaches) are suggested to be a notable factor in the successful promotion of learning for adults with specific learning disabilities such as dyslexia.

From these conclusions, the following recommendations for policy and practice are made:

i. Lecturers and tutors could embrace some of the good practice identified via this systematic review, for example, the use of instructional techniques, animation and a version of the pause procedure as part of their practice.

ii. Lecturers and tutors may consider more carefully if and when to provide handouts in a lecture situation. They are seen not to add benefit to learning and may even be a distraction from the learning tasks at hand.

iii. Lecturers and tutors could attempt to build more multi-sensory strategies into their lecture and seminar practices, such as the pause procedure, the Think Aloud Procedure, animation and the introduction of new discipline-specific language.

iv. Opportunities to engage learners in the use of appropriate ICT and AT should be taken, for example, the broader use of reading pens, voice recorders and laptops.

v. The ways in which learning material is delivered should be carefully planned, for example the delivery of material and tasks using specific methods of instruction.

vi. Consideration of how lectures and seminar-based activities that support the development of limited short-term memory and differences in the normal cognitive processing functions can be adopted to broaden access to materials and promote access to learning.

vii. Specialist, structured, multi-sensory teaching delivered by appropriately trained specialist tutors should available for those with more severe dyslexic problems as they may support learning.

viii. Basic awareness training for lecturers and tutors that, a) teaches about the effects of dyslexia in adulthood and its impact on learning; and b) explores how teaching practices can be modified to increase access to learning could be offered.

ix. Mentoring to support learning both inside and outside the classroom could be made available. This should include some dyslexia-awareness training for the mentor if possible.

The question remains as to whether the findings of this systematic review reveal an issue that is significant enough to warrant HEIs reviewing and considering changes to their regular learning and teaching practices and their more general support mechanisms. As long as legal requirements are upheld, the issue of whether dyslexic adults are having the best learning experience they can, or not, may be irrelevant. As long as the students themselves are having their expectations met, do not 'challenge' their learning experiences and are 'satisfied' with what is provided to them on request, and if the attrition of students with dyslexia is not a significant enough issue for HEIs to be concerned about – then perhaps it is not an issue at all. However, what the systematic review does demonstrate is that there is very little attention paid to this area in terms of good quality research. This could be because there is a relatively small number of dyslexic students or that the currently available support is adequate. Further robust research is required to explore this area in more detail.

4.7 Scope and limitations of the systematic review

The quality appraisals undertaken for each of the studies included in this review indicate that five were of low quality, two were of moderate-low quality and only one was rated as being of moderate quality. The conclusions considered the implications of this, and therefore making judgements claiming to be generalisable to the population at large was avoided.

A lack of RTCs (three of the 8 single studies used this design, but in two of them it was combined with QED) did influence, to some extent, the ability of the studies to claim any causal outcomes for the interventions evaluated. Some of the QEDs also had issues around the way the groups were allocated and also a lack of control groups. Also, the literature review included in the data synthesis contained evaluations of a range of experimental, quasi-experimental and non-experimental studies.

Overall, the nature of the studies included in the systematic review data synthesis did not present evidence for clear conclusions to be drawn. Although the studies included were not qualitative and did seek to answer causal questions the studies had major methodological flaws which did not test the outcomes sufficiently.

None of the studies that was included in the review for data synthesis could be categorised only as being focused upon ICT and AT as a separate theme. The studies that discussed the use of ICT and AT covered one or more of the other themes in the review and so these were developed as sub themes. This may suggest some naivety in the expectations of what the database searches may have found in terms of ICT and AT as a concept that could have been de-coupled from learning and teaching per se, especially given the nature and focus of the question. In any respect, this demonstrates that the searches completed for the systematic review were successful, since all studies that included elements of the evaluation of ICT and AT were located via the search strategy.

The studies included in the systematic review data synthesis were small in sample and relatively limited in scope, as outlined in the conclusions and recommendations, but it was still possible to take some implications for future practice from them.

There are pockets that demonstrate how practice could be adapted to improve access to learning for adults with dyslexia if we take them at face value. However, their general success across a larger population is not something that can be claimed without further investigation into that larger population.

The consideration of the other published research in this field, of any design, may uncover additional aspects of support that are not included in this evaluation of experimental and quasi-experimental research only.

Chapter 5 Data Synthesis and Discussion: The Website Survey and Documentary Analysis and the Systematic Review

5.1 Introduction

The triangulation protocol (Farmer, Robinson, Elliott and Eyles, 2006) was the procedure used to facilitate an overarching discussion and evaluation of both sets of data and allowed this combined data to be considered from a number of angles (Burns and Grove, 1997). The triangulation protocol provided a vehicle for a holistic picture of the support offered and/or promoted to learners with dyslexia on programmes of HE, based on the research evidence, firstly, to be established, and secondly, to be triangulated against the contents of the literature review (Chapter 2). Brining the two sets of findings together strengthened the evidence base (Burke Johnson and Christensen, 2016; Johnson and Onwuegbuzie, 2004; O'Cathain, Murphy and Nicholl, 2010) and enabled clearer evidential links to be made between the overarching research aims and the research questions, the data collected and the conclusions of the research (see Chapter 6). The decision to combine the research data also provided opportunities to discover additional findings over and above those that single separate analysis can establish.

5.2 Data synthesis method

The method of triangulation enabled meta-themes to be identified. Analysis by thematic comparison was completed in four stages: the first stage looked for agreement across the sets of data; the second stage looked for partial agreement; the third stage looked for silence (where the findings from one set of data are not reflected in the other; Fielding and Fielding, 1986); and the fourth stage of analysis established dissonance or disagreement across the two data sets (Erzberger and Prein, 1997; Farmer, Robinson, Elliott and Eyles, 2006; Foster, 1997).

Before the analysis of the combined data is presented, attention is drawn to the limitations of the data collected both from the website survey and documentary analysis, and the systematic review. The website survey and documentary analysis were based upon a 10% sample of HEIs in England; although the sampling approach taken ensured as wide a representative sample as possible was included in the data collection, a different sample may have yielded different results. With reference to the systematic review, the studies included in the data synthesis were not of the most rigorous design. The studies were, in the main, of QED (with one RCT and one combined RCT/QED in the data synthesis. Often the groups used as control groups were created from the learner characteristics and more often than not, all participants received the treatment. So, in fact, these were comparison groups rather than true control groups. As a result of this, following a rigorous quality appraisal process, none of the included single studies was judged to be high quality. One out of eight had moderate quality, two of the remaining ones had moderate-low quality and the rest (five) were of low quality. The one literature review in the data synthesis was also of moderate quality. The quality of the studies is referred to within the following discussions, but just to emphasise here, the findings from the systematic review data synthesis are only given the appropriate evidential weight reflective of the overall rigour or quality of the studies included.

Tables 17, 18 and 19 contain three separate protocol matrices for the research findings. These are presented in the themes and sub themes identified as a result of the website survey and documentary analysis and the systematic review research. Each of these is followed by an analysis of the combined data.

Table 17: Triangulation protocol matrix for the theme of teaching, learning and inclusive practice

Evidence source: Website survey and documentary analysis	Evidence source: Systematic review of experimental and quasi-experimental research	Judgement
There were few attempts to adapt the curriculum or the learning and teaching strategies used in the lecture and seminar situation to increase the accessibility of the curriculum for adult learners with dyslexia	Pausing in lectures may help to promote learning for all participants, including those with specific learning difficulties such as dyslexia. Teaching approaches that utilise a whole-picture or holistic approach, and use a range of logically developed strategies, including schematic illustrations, may improve the performance of dyslexic adults in certain areas of learning. Explicit instruction continues to be a practice that is supported by research and that is useful to the promotion of learning for those both with and without a specific learning difficulty. Teaching approaches that utilise the multi-sensory strategy (see, hear, say, do) can, if delivered appropriately, support more effective learning for all, but will provide increased curriculum access (and learning) for those with dyslexia.	Partial agreement
Most institutions state that 'adjustments can be made on request'. There is no indication what these adjustments might be, beyond the use of coloured paper and requests for different typefaces, which can be accommodated.	A range of in-class adjustments and adaptations to learning and teaching methods could be used to promote the learning of those with dyslexia.	
The provision of notes and presentations a week prior to a lecture was considered.	The provision of notes and handouts in lectures appears not to enhance learning.	Partial agreement

5.3 Discussion: teaching, learning and inclusive practice

Across the combined data, there is partial agreement about how curricular adaptations are managed to support learning. What the combined data indicates is that there are several adaptations for designing and delivering learning and teaching activities available that would better support the adult learner with developmental dyslexia, but that they are not widely implemented (see table 17).

The studies in the systematic review data synthesis evidence evaluated a number of interventions which are now explored. Pausing in lectures with directed facilitated discussion (Ruhl, Hughes and Gajar, 1990; Ruhl and Suritsky, 1995) provides opportunities for the lecturers/tutors and the learners to give attention to the exploration of newly introduced concepts and terminology, to dedicate time to exploring the meaning and the structure, and to relate the new terminology to the wider curriculum in order to promote understanding. This is useful as difficulties arise with more complex and unfamiliar language as decoding is more difficult and the meaning of text can be delayed or lost completely. This is a regular observation in learners with dyslexia and is explored within the phonological 'deficit' hypothesis of dyslexia as discussed in chapter 2, the literature review (pp.17-19), where it is noted that the deficits associated with this hypothesis, such as limited short-term memory capacity and an absence or delay in visual-verbal coding; inability to retain visual representation of words (a lack of single word recognition, or automatic memory) all add an additional burden on the cognitive function of reading (Breznitz, 2008; Frith, 1992; Gathercole and Pickering, 2000; Snowling, 1987; Swan and Goswami, 1997b). Although the findings from these two studies of QED claim an outcome of statistical significance, the overall rigour of both of the studies was evaluated as moderate in terms of internal and external validity, and although the findings are useful to reflect upon and their relevance to the focus of the research aim was high, the design of the research limited its ability to be generalised to the wider population with complete confidence.

The combined data from the two studies suggests that regular pauses and attention to new or unfamiliar terminology may assist the dyslexic learner in understanding the content of more complex reading materials presented and will also allow more time to process information and take a fuller part in any discussion. It is certainly not considered to be harmful to the learning process and may be seen to provide some advantage to the learner with dyslexia in accessing curricular content. The teaching and learning methods outlined in Table 17 taken from the systematic review data may be more successful for adult learners with developmental dyslexia as they enhance the delivery of information by using multi-sensory and/or multi-modal approaches to teaching and learning (utilising a see, hear, say and do approach; Lee, 2002; Smith, 1996). The programmes are also planned and delivered in a structured and strategic manner with appropriate instruction. Two studies included in the systematic review data synthesis tested approaches to learning which used a range of logically developed strategies. These included schematic illustrations (Zawaiza and Gerber, 1993) and explicit instruction (Hock, 2012) which it is claimed will not only significantly improve the performance of adults with developmental dyslexia but will also benefit learners without learning difficulties and/or disabilities in certain areas of learning. Although the findings from this single study and Hock's (2012) literature review in the systematic review data synthesis suggest that these more general instructional teaching and learning strategies are helpful for increasing access to learning for all learners, including those with different types of developmental dyslexia, this evidence base is not compelling. Both of these studies were evaluated as having an overall moderate quality of rigour. The external validity of the Zawaiza and Gerber (1993) study was judged to be low and so any claims made regarding the applicability of the findings of the study to a wider audience was adopted with caution. The Hock (2012) literature review included studies of mixed design and as a result of this, any overarching interventional claims made were based on differing types of evidence, some of which was experimental/quasi-experimental and some which was non-experimental. Therefore, any effectiveness outcomes claimed as a result of the overall data synthesis in this literature review could not be fully corroborated. Having said this, even if the outcome effects are overstated in the single

study and the literature review data synthesis, one could argue that these types of instructional strategies are relatively easy to implement, and there is no evidence in the data collected to suggest they are harmful to learning. The evidence does lead one to think that there would be benefits in adopting these approaches in some learning and teaching situations where it is feasible to do so.

If we then consider the website survey and documentary analysis data, fewer than half of the institutions made any reference to curricular adaptations to support access to learning for adults with dyslexia, and the ones that did were not explicit. One out of the 11 HEIs indicated that they would specifically adapt the curriculum to make it accessible for adult learners with specific learning difficulties (such as developmental dyslexia) and only an additional four institutions indicated that they would make 'reasonable adjustments on request' (see table 17). We can surmise from the website information that these reasonable adjustments are likely to be provision of notes and presentations a week prior to a lecture, different colour paper/typeface requests accommodated and the use of tape/voice recorders and laptops and other AT used in the lecture and seminar, which is all good practice, rather than any significant adaptations to curricular delivery and/or teaching and learning practices, which may not be seen as providing significant enough benefit to be widely implemented in HE teaching practices.

It is also apparent that the onus on accessing reasonable adjustments of this nature is in the hands of the learner themselves. Five out of the 11 institutions stated that note-takers were available (if the appropriate evidence of assessment needs was in place) and around half of the institutions surveyed did not mention curricular adaptation being considered at all. It can be concluded from this that the adjustments cited as available at the time of the website data collection and analysis are unlikely to include any of the adaptations to classroom teaching and learning practice that the systematic review findings indicated would be of benefit to adult learners with (and without) dyslexia.

It can be argued that some of the adaptations discussed in the systematic review data synthesis may be relatively easy to achieve if the will is there. For example, embedding the use of regular pauses and discussion in lectures; consciously planning for and using a range of teaching and learning approaches to promote the use auditory, kinaesthetic, visual and oral channels; and adopting some specific types of instruction, such as strategic instruction (as outlined in table 17) would all assist in the promotion of learning. However, in order to implement any of this without a change to institutional learning and teaching policy, some additional thought, time, attention and an individual desire to change the planning and delivery of sessions to make learning more accessible would be required. Further to this, in order to make a case for the implementation of all, or any, of these curricular adaptations as part of wholesale change to learning and teaching policy and practice in HE, there would need to be a larger and better quality evidence base. The combined evidence found in this research is not sufficient to warrant a review of HE policy and practice in this area, given that a change of this scale would lead to some disruption of current learning and teaching custom and practice across the sector. For this to happen, a considerable cultural and pragmatic shift among those affected by any policy change of this nature would be needed.

Having said this, what cannot be discounted or ignored is that the number of learning disabled students accessing HE is steadily increasing (Hefce, 2016), and the probability of developmental dyslexia in the general population means that around 43% of these learners with a reported learning disability will have a diagnosis of dyslexia. Therefore, a greater number of lecturers and tutors involved in teaching HE programmes will have increasing numbers of adult learners with a diagnosis of dyslexia sitting in their classroom at any one time. Whether the needs (perceived or otherwise) of this increasing number of learners can be met in the future without a review of teaching and learning policy and practice remains to be seen. One could say that it is acceptable (and only right) that changes that could make learning more accessible for all should be left to the individual professionalism and desire of the tutor or lecturer to change them, rather than any overarching evaluation and/or potential

review of current teaching and learning policy and practice, especially one based upon a relatively weak evidence base. One could also argue, however, that leaving this to chance is not good enough for those learners who may benefit from adaptations to delivery that will enable increased access to learning. This research has shown that there is limited research of poor quality in the area of which interventions work to promote the learning of dyslexic learners in HE. With increasing numbers of students experiencing dyslexia likely, greater attention and funding in this area of research is needed.

Table 18: Triangulation protocol matrix for the theme of additional learning support and study skills support

Evidence source: Website survey and documentary analysis	Evidence source: Systematic review of experimental research	Judgement
There are significant differences in the types and consistency of support promoted to adults with a diagnosis of dyslexia. Some is deemed to be 'specialist' and some 'generic'. The 'bolt-on' additional learning support (ALS) model is by far the most utilised option.	There are a range of out-of-class strategies for support that could be utilised more appropriately to promote the learning of those with dyslexia.	Partial agreement
There is a level of generic support available across all institutions that appears to meet the requirements of the Equality Act 2010 (and its predecessors, DDA 1995 and SENDA 1993).		Silence
Some institutions claim to be offering dyslexia-specific additional learning support, but, on analysis, where details are provided, this in fact appears to be general study skills support delivered via traditional teaching techniques rather than any specialist approaches or methods.	A multi-sensory structured learning programme delivered as additional learning support can improve reading and spelling, but it should be fit for purpose and delivered by specially trained and appropriately qualified staff.	Partial agreement
Some institutions had more detail about the types of examination adjustments/considerations they could offer to adult learners with dyslexia. Some did not make reference to it at all.	Exams may not provide an equitable opportunity for adult learners with dyslexia to demonstrate their knowledge.	Partial agreement
Some institutions did not appear to offer a thorough analysis of learning needs or dyslexia screening.		Silence

	Coursework-type assessments appear to be better than exams in promoting fairness and enabling dyslexic learners to be given the opportunity to demonstrate their learning in as equable a manner as possible.	Silence
All institutions had a central disability service with 'specialist staff' available, but the vast majority had sketchy details about what this was for learners with specific learning difficulties (or dyslexia).	Training and development of staff in knowing and being able to use these methods (including some knowledge of the benefits and use of multi-sensory teaching and learning approaches) are a notable factor in the successful promotion of learning for adults with specific learning disabilities, such as dyslexia.	Partial agreement
Mentoring was seen to provide great benefits for students with dyslexia. Only one institution had mentors trained in dyslexia awareness. Fewer than half of the institutions surveyed offered a mentoring service to students.	When the pause procedure is combined with the use of a mentor who is trained in directing discussion it may support improved access to learning.	Partial agreement

5.4 Discussion: additional learning support and study skills support

5.4.1 The implementation of additional learning support and study skills support

It is clear from the combined research data (see table 18) that the preferred model of providing additional support for learning is one that happens outside formal class contact time; the 'bolt-on' model is by far the most utilised support option. This is significant as it lays down a marker as to how the support for adult learners with developmental dyslexia (and other learning disabilities) is seen as being separate from classroom learning and teaching practice and therefore outside the responsibility of the classroom lecturer or tutor. This also supports the findings that there is minimal adaptation to classroom practice to promote access to learning, as discussed in section 5.3.

From this, we can deduce that it is the additional learning support services available to the learner outside formal class contact time that are relied upon to address the majority of the additional needs and requirements of learners, and not the tutors or lecturers themselves. This removes, to some

extent, any responsibility the classroom lecturer or tutor may feel in relation to making their learning sessions more accessible. If lecturers and/or tutors believe that the learners are accessing services outside the classroom that will support their academic learning and development sufficiently, this could, in fact, be viewed as 'effective learning support' and the desired 'levelling of the playing field'.

However, for the adult learner with dyslexia to fully access learning, a holistic and organised approach to learning is required. It appears, as far as can be deduced from the combined findings, that this is currently a segregated, fragmented and disjointed approach to learning and support which is viewed as two separate concepts delivered by two different, distinguishable sets of individuals. This is not good practice and is an area of future consideration for development. A combined strategic approach to both internal in-class adaptations and out-of-class learning activities, planned and actioned by an appropriate set of people, could provide a much more integrated approach to the learning experience of the adult learner with dyslexia. To put it another way, if both in-class and out-of-class teaching and support activities were planned collaboratively by tutors/lecturers, additional support tutors and mentors, this could be a way of providing a rounded and supported learning experience for adult learners with developmental dyslexia. All of the institutions stated that they had a central disability service with 'specialist staff available', so perhaps some joining together of, or a liaison between, these specialist teaching staff and general academic lecturers and/or tutors would make a notable positive difference to the experience of the learners.

5.4.2 Content of additional learning support

The combined data, as indicated in table 18, indicates that there are significant differences in both the types and the consistency of the support promoted to adults with a diagnosis of dyslexia. Some of this support was described as 'specialist', the other that is discussed, for the purposes of this discussion will be referred to as 'generic' support. Around half of the institutions in the website survey and documentary analysis sample did not offer specialist support outside the classroom. Around half

claimed to offer specialist additional support packages. Only one of the HEIs included in the website survey and documentary analysis made specific reference to the use of multi-sensory approaches to learning and this was via additional learning support packages. It has been established in the literature review that additional learning support, or programmes of additional literacy (reading and writing development) for adults with developmental dyslexia involves structure in learning, overlearning and multi-sensory techniques. This evidence suggests that delivering a specific set of instructional strategies that focus upon developing the specific skills associated with reading and spelling, via structured language programmes (as outlined in chapter 2, pp. 27-28) may improve the reading and writing performance of those with dyslexia (Hornsby, Shear and Pool, 2006; Lee, 2002; Reid, 2017; Dyslexia Action, 2017b; British Dyslexia Association, 2017,).

This view is corroborated by the Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) studies included in the systematic review data synthesis. In terms of the rigour or quality of these studies, the Guyer and Sabatino (1989) study was an RCT and the Guyer, Banks and Guyer (1993) study had a combined RCT/QED design. These designs would suggest the potential for strong and rigorous studies, but on appraisal they did have some issues related to design (or internal validity) and were judged to have a moderate–low internal validity. This was due to an absence of detailed information on how individuals were allocated to groups and also followed up. Both of these studies were given a high relevance quality judgement, so were extremely valuable to the research aims from this perspective. The external validity (generalisability) was moderate and the overall rigour of both studies was judged to be moderate. Although there were some issues of quality, the studies did add value to this research in respect of how they tested the usefulness of prescribed structured language programmes taught to students in HE using multi-sensory methods as indicated in table 18. The Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) studies claim that there is evidence that a multi-sensory structured learning programme such as the Orton-Gillingham, or equivalents such as the Alpha to Omega (Hornsby, Shear and Pool, 2006) will support reading and spelling performance more than traditional

teaching methods. The claims made regarding the marked improvement of the learners with dyslexia on the multi-sensory structured programme (as opposed to the control and non-phonic group) were notable. Further to this, many dyslexia specialists (and advocates) in the field support this viewpoint (Hornsby, Shear and Pool, 2006; Lee, 2002; Reid, 2017; Dyslexia Action, 2017b; British Dyslexia Association, 2017).

Also, structured multi-sensory language study packages of this nature, if delivered appropriately, can help to negate some of the other learning issues associated with dyslexia, such as deficits in skill automatisation and limited short-term memory capacity as indicated in chapter 2, p.20 (Fawcett and Nicolson, 1999). This is because the skills these packages develop in the learners can be transferred into the lecture/seminar situation. It is significant that only one of the institutions in the website survey sample appeared to offer this specific type of support, based on the information available.

Some additional institutions, within the website survey and documentary analysis, claim to be offering dyslexia-specific support. However, on analysis, where details were provided, this in fact appears to be general study skills support rather than any specialist approaches or methods that arguably might better assist access to learning for a student with developmental dyslexia (Lee, 2002). If on closer examination this should be the case, this suggests that this truly specialist support could be available at fewer than half of the institutions surveyed. This is a very different proposition to the over half that initial examination of the website text suggested. Where more detail was provided, examples of some of the range of support services on offer included one-to-one dyslexia tuition and small study skills workshops. There was also some evidence of consideration of the wider issues that dyslexia can bring in the data for these institutions. For example, the development of coping strategies and dealing with anxiety are part of the 'support package offered'. Two of the institutions in the website survey and documentary analysis had downloadable study support packs, which may prove useful to learners with general study skills needs. However, the format of these would not necessarily be useful to

learners with dyslexia who rely greatly on interactive and repeated learning presented in a format compatible with multi-modal information processing (visual, auditory, tactile and verbal) (Lee, 2002). The development of proof-reading and exam preparation skills is evident across all of the institutions in the sample and there is less focus on developing reading skills generally based on the evidence from the combined data. This is not surprising, given that by adulthood, most adult learners with dyslexia have mastered the skill of reading or the ability to compensate (Lee, 2002). This is demonstrated to some extent by the outcomes of experimental PET scans which showed that some adults with dyslexia can perform in the average range in some tests of reading (Paulesu, Frith, Snowling, Gallagher, Morton, et al. (1996) (see chapter 2 p.18).

In summary, how widespread or useful any, or all, of these strategies are in the overall learning experience of the adult dyslexic in HE is unclear, based upon the combined evidence (see table 18). It may be that the institutions offer much more rounded and specialist support than this combined data suggests. For example, perhaps more institutions do offer the types of structured language programmes that are effective, but they are not promoting them as well as they might. It could also be that the institutions are assured that the support currently on offer meets the learning needs and demands of the majority of their students, including those with developmental dyslexia, and that wholesale access to this type of specialist support is not necessary. What is clear, however, is that there are a range of out-of-class strategies and activities that could and should be utilised more effectively to promote the learning of those with dyslexia.

5.4.3 Initial assessment of needs and diagnostic assessment of needs

The findings from the website survey and documentary analysis, as indicated in table 18, suggest that some institutions do not offer a thorough analysis of learning needs or dyslexia screening to support the planning and implementation of either additional learning support programmes or for assessment

concessions to be put in place. The systematic review data did not establish any evidence for or against this position.

Although technically this relates to implications on the assessment process rather than the learning process, assessment is a crucial aspect of learning, and assessment is the way in which that learning is demonstrated. If this is not an inclusive process, then it is presenting a barrier to a learner demonstrating that knowledge (Powell and Tummons, 2011).

Some institutions had more detail about the types of exam support they offered, e.g. extra time, a separate exam room, an amanuensis. The examinations concessions information suggests that this is the 'standard reasonable adjustment' that is a typical pattern in HEIs.

All the institutions stipulated that a full assessment report, with recommendations suggesting these adjustments, must be provided before any adjustments could or would be made. Seven of the 11 institutions offered a dyslexia screening service (not considered to be a sufficient evidence base to warrant exam concessions) and only eight out of the 11 surveyed offered full psychological assessments (which would provide the evidence necessary). This means that three of the HEIs sampled would rely on another mechanism for the provision of these types of assessment such as referring the students to an independent service, e.g. Dyslexia Action, for an assessment. There are financial implications related to this, and although the student may be able to claim back any associated costs, the initial financial outlay for the completion of the psychological assessment and subsequent report in a timely manner may be a significant enough barrier to prevent the learner from pursuing this. From a pragmatic perspective, a learner with dyslexia who comes to the institution without a full psychological assessment would need to access this assessment and have the associated report with recommendations before any reasonable adjustments could be made. A time delay of just a few weeks in accessing a full psychological assessment and the subsequent report production could lead to a

learner being more than halfway through his or her first year of study without having any additional adjustments to either their learning or assessment being made. There is a possibility that this could be related to the high first-year attrition rate for adult learners with dyslexia, as evidenced by the National Centre for Special Education Research (2014) and Richardson and Wydell (2003).

Not directly linked, but related, is the issue of poor self-esteem and anxiety as a result of the repeated failure often seen in learners with dyslexia (Riddick, Sterling, Farmer and Morgan, 1999). Placing them in a potentially unsupported situation for an unspecified amount of time could lead to issues with attrition early in the course of study. For those learners that do not leave, these types of experiences could be reflected as issues with 'satisfaction' about their learning experience, when they come to complete the NSS. This could be a contributing factor as to why satisfaction scores are lower for adult learners with dyslexia. A lack of appropriate support may also be related to the general lower satisfaction scores for all learners identifying themselves as having a learning disability.

5.4.4 Examinations and coursework assessment

Osborne's (1999) study of quasi-experimental design was included in the systematic review data synthesis. This study discussed coursework assessment and examination concessions and how they may disadvantage learners with dyslexia over non-dyslexic learners (see table 18). The study had a moderate–low internal validity judgement and a moderate relevance and external validity judgement. Its overall rigour was moderate. This suggests that there is some value in considering the outcomes for this study, although they must be treated cautiously. This study claimed that a significant issue for adults with dyslexia is time-bound pressure in exams (see table 18). Additional research has shown that exam anxiety is very high in a high number of adults with dyslexia generally, and worse when they are forced into an examination situation (Carroll and Iles, 2006; Tsovili, 2004).

Evaluation of the combined data from the website survey and documentary analysis and systematic review suggests that there is limited use of alternative assessment methods in place for adult learners

with a diagnosis of developmental dyslexia. It would appear that there is little being done regarding the use of alternative assessment methods. It was difficult to establish current practice in this area in a concrete way across the HE sector as the information from the sample in the website survey and documentary analysis focused on examination concession and support in examinations rather than any alternative methods of assessment available. Also, only one study within the systematic review, Osborne (1999), specifically discussed this. This study did, however, establish that coursework assessments are more accessible and less stressful than assessment by examination for adult learners with developmental dyslexia. It also established that coursework assessment was seen to promote fairness and provide the dyslexic learner with an opportunity to demonstrate their learning in as equitable a manner as possible, though the caveat to this is the overall quality of the study design, which was relatively weak in terms of proving a direct link between the interventions and their effects. Stronger evidential research is needed before this can be identified as an area for HE policy or practice review.

5.4.5 Staff awareness and training

The combined findings, as indicated in table 18, did not establish any specific information in relation to the scope and provision of dyslexia training or staff awareness. It did, however, discuss the use of multi-sensory approaches to learning and teaching (in the Guyer and Sabatino (1989) and Guyer, Banks and Guyer (1993) studies) and stress the point that this can only be delivered effectively with some appropriate training or staff development.

This is reiterated in the literature review (chapter 2, pp. 27-28) where it is the general consensus that training and development of staff in both being aware of and able to use these methods are a notable factor in the successful promotion of learning for adults with dyslexia (Morgan and Klein, 2000; Lee, 2002; Reid, 2017 and Smith, 1996). Further to this, the programme content and the level it should be 'pitched at' for any multi-sensory support programme must be fit for purpose, or to put it another

way, it must be designed and delivered by specially trained and appropriately qualified staff and be negotiated and agreed with the learner.

5.4.6 Mentoring

The role of mentoring and coaching in HEIs was the next area of significance that became apparent. The combined findings (as outlined in table 18) established that mentoring was seen to provide significant benefits for students with dyslexia. The role of the peer in education as a conduit to learning is not a new concept. Much research has been completed regarding the use of peers in learning, particularly in relation to the scaffolding of learning where the peer supports the learner in achieving the learning task (King, 1997; Topping, 2005; Vygotsky, 1978; Wood and Middleton, 1975; Wood, Bruner and Ross, 1976). Scaffolding is proven to make a significant difference in the learning of those with developmental dyslexia (Smith, 1996). A mentor who is both trained in instructional techniques and also in dyslexia awareness could act as a significant catalyst for learning in a classroom situation if utilised appropriately. Further to this, Wallace and Gavells (2005) explored the role of the mentor and coach in their research about mentoring support and adult learners. This research suggests that a learning mentor can assist in a range of ways, such as evaluating needs, sourcing equipment, delivering study skills support, helping with day-to-day organisation, proof-reading, exam support and so on. A mentor trained in dyslexia support could do all this and more, for example, understanding the day-to-day issues associated with dyslexia, such as poor time-keeping, forgetfulness and spatial issues, and assisting in the development of multi-sensory strategies to learn spellings and strategies for developing short-term memory capacity. This could occur alongside the ones more directly related to learning such as assisting with comprehension, writing and spelling, and identifying and promoting techniques for learning in a way that will enable the dyslexic adult to develop strategies to take control of their learning. A mentor can also support the learner pastorally, which is also important given the confidence and self-esteem issues an adult learner with dyslexia may experience (Riddick, Sterling, Farmer and Morgan, 1999).

Fewer than half of the institutions in the website survey and documentary analysis sample offered a mentoring service to its students and only one of the institutions provided a mentor/coach who was a specialist in dyslexia support. The website survey and documentary analysis information did not give any specific detail of how the use of mentoring was operationalised at a practical level within the relatively small number of institutions that advertised this service. There was no reference to the use of mentors to support in-class learning and this is an area in which clarity is needed. This is especially important given that the Ruhl and Suritsky (1995) and the Ruhl, Hughes and Gajar (1990) studies in the systematic review data synthesis (which were both of moderate quality) claimed that significantly better learning outcomes were seen in their pause procedure when it was combined with the use of an in-class facilitator (or mentor) as indicated in table 17. The role of the mentor/peer learner in this situation was partly to aid the development and retention of new knowledge via the process of scaffolding learning and by directing discussion. These studies demonstrated improvement in immediate free recall and on tests taken after the lecture sessions. The learners also produced a better quality of content of notes from the lecture input, which was an additional unexpected, but very positive, finding from the research.

The mentor, if in place, could be the vital link between the lecturers, the support services and the adult learner with dyslexia. This approach to holistic support may help to reduce attrition rates in first-year undergraduate learners with dyslexia and also improve their satisfaction with their learning experience. The use of a learning mentor, preferably a dyslexia-aware mentor, could also provide adult learners with dyslexia with a more 'level playing field' when it comes to both the learning and assessment process, for example, as an amanuensis in examinations or a sounding board for coursework assessment. Of course, all of this would be down to the learner being comfortable with the mentoring process and the development of a good working relationship with the mentor.

Table 19: Triangulation protocol matrix for the sub theme of information communications technology and assistive technology

Evidence source: Website survey and documentary analysis	Evidence source: Systematic review of experimental and quasi-experimental research	Judgement
Tape/voice recorders, laptops and other assistive technology can be used in the lecture and seminar if endorsed by the lecturer.	The use of a word-processor with a spell checker may improve the accuracy of recording information and appears to be the most acceptable to students with a specific learning difficulty, even compared with hand-held dictionaries and other assistive spelling resources. Some types of ICT and AT may provide increased access to learning for the adult learner with dyslexia.	Partial agreement
	The use of animation in lecture situations (which integrates aspects of multi-sensory learning and teaching) may promote learning for all learners but may be particularly beneficial to promote the learning of adult learners with dyslexia.	Silence

5.5 Information communications technology and assistive technology

The combined findings from the research demonstrate that ICT and AT), in various guises (as indicated in table 19), can be a significant support to adult learners with dyslexia if used appropriately. All institutions in the website survey and documentary analysis indicated that they had a range of IT equipment on loan e.g. laptop computers, digital voice recorders. Three of the institutions in the survey provided specific examples relevant to learners with reading and writing issues such as speech-to-text software and interactive thesaurus/dictionary software. It is also indicated in some of the website text that the recording of lectures is acceptable.

The study by McNaughton, Hughes and Clark (1997) of quasi-experimental design was included in the systematic review data synthesis. It had a moderate quality judgement in terms of its internal and external validity and a high relevance judgement. Its overall rigour was judged to be moderate. Although the internal validity for this study had some issues, and its generalisability was limited, it did

propose some interesting findings that were valid. The most important of these, in relation to the research aims of this thesis, was the finding that the use of a word-processor with a spell checker improves the accuracy of recording information above all other proof-reading conditions. The word-processor was also seen to be the most acceptable to students with a specific learning difficulty even compared with hand-held dictionaries and other assistive spelling resources.

Some research as outlined in the literature review (chapter 2, pp. 29-33) indicates that students with dyslexia, when using assistive software of this nature and other types of technologies such as reading pens with thesaurus and read-aloud functions, can perform at a similar level to their non-dyslexic peers who do not have access to these types of ICT and AT (Belson, Hartmann and Sherman, 2013; Schmitt, McCallum, Hennessey, Lovelace and Hawkins, 2012; Technology for Dyslexia, 2017). They appear to provide some benefits for adults with a specific learning disability such as developmental dyslexia (McNaughton, Hughes and Clark, 1997). Significantly, within the combined findings, there was little evidence of research conducted into tutor-led approaches to technology in classroom practice in relation to supporting adults with dyslexia (See table 19). One study in the systematic review data synthesis (Taylor, Dufy and Hughes, 2007) tested the use of animation in lecture situations (which integrates aspects of multi-sensory learning and teaching) to establish how effective it was in promoting new knowledge development by testing various skill sets and knowledge to be mastered, for example conceptual understanding or the mastering of a process. Although this study was of quasi-experimental design it was the one study included in the systematic review data synthesis that had a poor overall rigour (or quality). The internal and external validity was judged as low quality, which was a cause of concern in terms of the reliability and validity of the claims made. This study claimed that the use of animation did have a positive impact on learning for all who participated and that some characteristics of the intervention supported the adult learners with dyslexia in particular where conventional delivery would have not. However, the judgements made in the study cannot be relied upon due to issues of poor quality.

In summary, the evidence from the combined findings indicates that the use of ICT and AT is the most consistently cited method for supporting learners with dyslexia used both inside and outside the classroom setting. It would seem that ensuring learners with dyslexia have access to these types of technologies can only increase their access to learning.

Chapter 6 Conclusions, Recommendations and Future Research

6.1 Conclusions

The following conclusions and recommendations are based upon the evidence established by the triangulation of the findings discussed in Chapter 5. The aims of the research were:

> *to investigate the support mechanisms that are offered to learners with a diagnosis of dyslexia on programmes of higher education in England; and to identify and evaluate any interventional support strategies in use that may benefit these learners.*

The findings suggest that there is evidence of some good practice for the support of learners with dyslexia on programmes of HE. Practitioners should endeavour to continue to support access to learning in the lecture and seminar setting by making reasonable adjustments to their practice. The most common examples of these in the evidence were: providing handouts on coloured paper as requested; using a specified colour of typeface; allowing lectures to be recorded; providing a copy of notes or handouts some days before the session is taught; allowing the use of coloured spectacles or overlays in sessions; and advocating the use in class of hardware (laptops, tablets etc.) and access to ICT and/or AT in a form that suits the needs of the learners, in one form or another. There was also evidence of additional time for reading being granted in a number of the HEI websites' public information. This will help to support comprehension of the content of reading materials provided for a number of learners, not only those with dyslexia.

Every institution in the survey provided additional learning support opportunities, outside class contact time, for their learners with dyslexia. This was in fact the preferred mechanism for providing support to learners. The quality and appropriateness of the support offered appeared to be more in line with the potential needs of the adult learner with dyslexia in some institutions than in others. There were some areas of both in-class support and additional learning support practice that were

not supportive of the learning experience of adults with dyslexia, such as the use of non-interactive downloadable spelling and grammatical activities, and these should be reviewed.

An interesting finding claimed in the research was that providing handouts in lectures appeared to be a distraction from the focus of learning. There could be an argument to stop providing handouts altogether, or to provide them at the end of a session.

One aspect that arose as a result of the research as a by-product of the investigations, rather than as a result of any direct enquiry, was the potential damage to learning that could be caused by a long gap between the psychological assessment for dyslexia and the production of an assessment report. This report will contain recommendations for reasonable adjustments to classroom practice, will state any hardware, software and/or AT that should be obtained to help the learner and will outline any assessment and/or examination concessions required. The time gap between the psychological testing and the assessment report production can be substantial and during this gap, a learner will be left to manage their learning as best they can. Delay between the two will have an adverse effect on the initial experiences of a first-year undergraduate student and may explain, to some extent, the higher attrition rate seen in undergraduate first-year students with dyslexia.

An additional aspect of this issue is additional expense. In the website survey, at least one institution did not provide a psychological assessment service, and a number of others were unclear as to what specific type of assessment was available. If a full psychological assessment report is needed and not provided by the HEI, a private provider will need to be sought. Given this, the learner may opt to continue without the psychological assessment report and/or take up his or her studies without accessing the support that may help him or her to achieve. If the services offered by HEIs were efficient and quick, or alternatively, earlier access to assessment were available to ensure the test and report were in place before the learner commenced the programme of study, this area may cease being an

issue. A time delay of this nature will adversely affect the learning experience. HEIs should review their practices in this area.

Examination use is another area of potential concern. The data synthesis from the systematic review claimed that learners with dyslexia are at a disadvantage in examinations, yet they are a regular feature of the majority of undergraduate degrees. There is a line of argument that says examinations are there to test a particular skill set. This may be the case, but it could be argued that making a learner with dyslexia complete an examination, when other methods of testing their learning could be equally appropriate and acceptable, is not necessary; especially when other reasonable adjustments are available. However, this position does not always lead to positive staff attitudes about dyslexia, with some lecturers claiming that making reasonable adjustments, such as removing examinations, is equivalent to 'dumbing down' academic awards (Mortimore, 2013), in fact this is an issue which promotes the most notable dissension in lecturers. This, it seems, could be another area of tension between institutional strategy and individual practices that would benefit from additional exploration.

There was evidence within the documentary analysis of types of 'specialist dyslexia support' being advertised which was, in reality, study skills support delivered by the usual methods (downloadable study skills packs, small-group tuition for proof-reading, writing composition etc.). Although this in itself is good practice, and learners with dyslexia may gain some benefit from this type of support, it should not be promoted as specialist dyslexia support when it is not. This is not to say that general all-round study skills support would not be useful for learners with less severe dyslexia deficits. As outlined by Reid, (2017) and in the definitions of the British Dyslexia Association, (2017) and Dyslexia Action, (2017a) in the literature review, dyslexia is a complex condition with many facets (see Chapter 2, p. 22). A fully comprehensive specialist support package may be required for some learners with dyslexia, whereas others may need relatively straightforward help such as with proof-reading and structuring their work. References were made to specialist support in the website data, which on

closer examination showed a lack of understanding of what specialist dyslexia support should actually contain. This lack of understanding would suggest that, moving forward, there is some scope for awareness raising and training across the HE sector.

This research also demonstrates that there is a divide between the activity of the academic lecturer and/or tutor and the learning support tutor when supporting a learner with dyslexia. These are seen as two very different aspects of support that are not joined together in a meaningful way to put the learner at the centre of the support process. The experience of the learner may be improved by a more holistic and planned, or 'rounded package' approach to their support which would be more in line with the social model of disability rather than the medical model. This would, in fact, reflect more closely the models of support that HEIs seem to aspire to as part of their operation and strategy, but which in practice seem to become fragmented and broken at the point of delivery. A survey of 164 lecturers across 12 UK universities (Ryder and Norwich, 2018) found that although tutors had a positive attitude to students with dyslexia in relation to 'reasonable adjustments' this positivity was undermined by a lack of up to date knowledge and awareness of current research. Further to this, the survey identified that the staff included felt inadequately prepared to meet the needs of students with dyslexia. The findings of this survey also identified that, of the sample, only 40% of tutors had been offered basic dyslexia awareness training. In summary, the findings from this survey indicated that lecturers need to be armed with the necessary knowledge (although it is acknowledged that this is complex) about the condition of dyslexia as it is currently diagnosed, in order to ensure the effectiveness and quality of their teaching practices, as well as to engage fully with institutional and legislative policies and practices to ensure fair and equal access of opportunity for learners with dyslexia (Ryder and Norwich, 2018).

It could be argued that this apparently fractured approach to support is a long-standing model in the sector and works to an acceptable degree. However, the conclusions from the combined data suggest

that additional learning support and the services associated with this offered by institutions are too abstracted or removed from the classroom 'teaching and learning' experience to enable truly effective, inclusive, transferable learning to happen. What is clear from the evidence is that there is a conceptual 'gap' or 'a lack of linkage' between the activities of central support services and the activities completed as part of teaching and learning in the classroom. The 'hub and spoke' model, used by some HEIs (including my HEI's model) is a model of structuring support around a central hub team. This localisation, it has been suggested (Hefce, 2015), is not facilitative to a joined-up approach to supporting learning and can reinforce the perceived separation (in reality or otherwise) of the 'support team' from the 'lecturing/tutoring team'. This is interesting, as the structure of the support, in these instances, is not reflective of organisational claims which align the institutions to the social model of disability. Or to put it another way, the hub and spoke approach to support allows the issues faced by a leaner with dyslexia to be viewed in a 'deficit' model and therefore, to legitimately be 'someone else's problem' (the support team), whereas the social model puts the responsibility back into the scope of the lecturing/tutoring staff. This is despite the institutional strategies and policies which suggest the opposite and infers an unhelpful divide between institutional strategy and operation at the level of practice. This may be one reason why some institutions are choosing to move away from the hub and spoke model (Hefce, 2015).

With combined planning and thinking in a more strategic and joined up way, some of the issues identified by the National Centre for Special Education Research (2014) and Richardson and Wydell (2003) about lack of appropriate support and attrition could be addressed. Whether HEIs feel that the current way of organising additional learning support has a negative impact on learning progress and academic achievement for those with dyslexia cannot be evidenced via this research.

Perhaps the most significant conclusion is that the evidence base of information regarding the support and interventions identified for adult learners with developmental dyslexia in HE is patchy as far as

could be established in this research. It also cannot be directly claimed that a lack of appropriate support relates to satisfaction scores and attrition, though the research does suggest that there are many areas of practice that could be enhanced, and that this may go some way to alleviating concerns about the student experience and may reduce attrition rates.

6.2 Recommendations

There is a lack of awareness, in the promotional material, of what specialist dyslexia support actually comprises. A recommendation would be for HEIs to review the way that additional learning support is advertised, organised and delivered in an effort to be clear and explicit about what they are able to provide. However, the need to attract students may override any desire to do this.

HEIs should evaluate the lecturing and/or tutoring staff's awareness of dyslexia as a condition and its impact on learning. This should lead to staff development activity on targeted areas of practice in order for the dyslexic learners to be better understood and supported. In a political and social climate where lecturers and tutors are required to take responsibility for 'reasonable adjustments' to their learning and teaching practices (Hefce, 2015) this would seem to be a sensible starting point. Having said this, in the Ryder and Norwich (2018) survey, only 52% of lecturers were prepared to do all that was possible to make their teaching accessible to dyslexic learners. This suggests that, without a convincing and robust evidence base and change to policy, this could be met with resistance.

Finally, this research established that there is no overarching model of 'organisational good practice' that could be shared across the sector. However, there are many areas of existing practice, some of which are identified here, that could be implemented to support access to learning for those with dyslexia, for example, approaches to curricular delivery and teaching approaches, the use of mentors and a more holistic and joined-up way of promoting and offering support.

The findings of the research raise a number of issues in relation to policy and practice. There is a clear need to raise awareness of both the number of learners with dyslexia currently accessing HE and the ways in which the needs of these learners can be met in a holistic manner. More funding should be made available to support students with learning disabilities, more co-ordinated support and large scale RCTs should be commissioned to find more effective ways to support learners with dyslexia and the findings from these should be disseminated widely.

6.3 Strengths of the research

Although there is plentiful research about dyslexia, the areas identified as a focus for this research had not been explored in this manner previously. The combined website survey and documentary analysis was a unique way of evaluating the support services available across a range of institutions and enabled a comparison of like data from across institutions. The systematic review was also unique. It not only focused upon evaluating studies of experimental and quasi-experimental design only (this in itself is a first I believe), but it also used data outside the experiences of students on programmes of HE (or their equivalents) in England, for example, college students in the USA. This enabled the reported support experiences to be considered from both a national and international perspective, and for any effective intervention support to be identified, regardless of the country of HE study, and triangulated against the information gained from the website survey and documentary analysis data. This allowed for gaps in current HEI practice to be identified and discussed. This added a facet to the research that could have been overlooked had the exclusion criteria limited the studies to HE in England.

6.4 Limitations of the research

The first part of the research, the cross-sectional website survey and documentary analysis, used only one source of data collection. This was the publicly available information on the HEIs' websites. This one-dimensional approach was valid and justified within the scope of this research, as its intent was

to survey a sample of HEI information in order to gain an overview, at face value, of the advertised or promoted support available to adult learners with dyslexia as it was at that particular point in time. The sampling method and the judgements made from this relied upon the generalisation (to some extent) of practice being 'similar' at 'like' institutions. To explain further, a 10% sample from red-brick, ancient, and modern universities (proportionate to their overall number) was selected for the sample across a broad geographical area (in England). The 10% sample was large enough to give a fair representation of activity in this area across the sector and to provide a solid evidence base for some justified conclusions to be made. This was vindicated during the course of the data extraction when it was clear that data saturation had been reached by institution HEI9. This gave credence to the judgements made based on the data extracted from the sample institutions in the cross-sectional website survey and documentary analysis. Perhaps a larger sample would have given different results, and this is a potential limitation of the website survey and documentary analysis findings. In addition to this, if the research were to be carried out again, an additional facet that could be added is the inclusion of primary data collection in the design. This would be taken from the sample institutions in the website survey and documentary analysis. This could be gathered through focus group interviews and/or one-to-one interviews with a selected targeted number of students with dyslexia, academic teaching staff and academic support staff. This would provide opportunities to 'get behind' the website information and would enable the collection of experiential data from a range of different perspectives. This may have identified different conceptual viewpoints for analysis and led to a different set of outcomes or further questions for future exploration. This type of data could not be collected by the website survey and documentary analysis, but it would be an interesting additional area to pursue. This was not completed as part of this research as the intention had always been to explore the types of provisions institutions say they have and the policies related to such advertised provisions.

With reference to the systematic review, the decision was made to include only studies of experimental and quasi-experimental design. This approach was taken with the aspiration to achieve reliable evidence base for any conclusions drawn in the systematic review data synthesis. However, it was startling to discover the sparsity of good quality experimental research, despite the many policy agendas about inclusivity. Further to this, the recent Ryder and Norwich (2018) study suggests that there is little wide scale systematic research about dyslexia and dyslexia related issues in HE. The studies of experimental or quasi-experimental design that were located for this systematic review were of mainly low or moderate-low quality and were limited in number, therefore the evidence base identified by the systematic review was weak. The main defining factor that justified the inclusion of experimental or quasi-experimental studies only is that the systematic review's intent was to enable an effectiveness question to be answered. If the searching strategy and inclusion criteria had been changed to encompass studies of additional design, then it would not have been possible to make causal inferences from the data extracted and synthesised in the systematic review, thus rendering its purpose obsolete. There is also the possibility, on reflection, that a more sensitive search strategy may have led to different search results.

There is an abundance of research which is not of experimental design, much of this is included in the study as context. For example; the Pino and Mortari (2014) study, which evaluated dyslexia support in HEIs but used descriptive data as its main evidence source and the Rice and Brooks (2004) literature review which also focused the majority of its work on descriptive research. Further to this, there are many more studies and publications referred to in this thesis which are still valued in practice despite their descriptive nature (for example: Belson, Hartmann and Sherman (2013); Hornsby Shear and Pool, 2006; Lee, 2002. The Hefce (2015) commissioned research study and the Ryder and Norwich (2018) survey.) These publications were not included in the systematic review data synthesis as they were not of the necessary design or did not meet other additional inclusion criteria.

Clearly, there is a lack of robust studies in the area of HE support for learners with dyslexia. This could be for a number of reasons, such as a lack of funding to enable the completion of good quality research, a lack of awareness of the issues faced by learners with dyslexia in higher education and possibly because it has not been raised as a significant concern by the learners themselves. Also, the relatively small proportion of learners with dyslexia in the student population may be assisting in disguising any pertinent issues.

The overarching nature of some of the themes led to some careful consideration in placing them in an appropriate position for discussion. For example, coursework adaptation (assessment) and exam concessions (assessment) were finally placed under the themes of teaching, learning, inclusive practice and additional learning support/study skills. Perhaps a different way to present these two areas could have been under an additional theme: assessment. However, as this was a relatively small aspect of the research, and assessment practice was not a primary focus, the decision was made to keep them within the two most closely related themes.

6.5 Potential avenues for future research

Further areas for research that may be useful are:

The completion of further primary research to establish, in detail, what is happening in current practice is a potential avenue for future research. It may be that existing practice regarding curricular adjustments and additional learning support (including the use of ICT and AT) to promote inclusive practices for adult learners with developmental dyslexia is more integrated and widespread than this data gathered suggests. An in-depth evaluation by survey and follow-up interviews at the lecturer/tutor level across a sample of HEIs may provide more in-depth data as to the intricacies of classroom practice and also their views on study skills practice for the support of adult learners with developmental dyslexia.

A review of how ICT and AT is used in current practice could be carried out to establish the current position. This is in order to identify good practice and perceived barriers to the use of these technologies for supporting adult learners with developmental dyslexia.

A survey of the students themselves could be completed to gather additional findings that would be complementary to the findings of the cross-sectional website survey and documentary analysis and the systematic review. The adult learners with developmental dyslexia should be questioned about what their barriers to learning are, which enhancements make for a better and more satisfying learning experience and suggestions for how they may be better supported. Certainly, the Hefce (2015) report suggested that there was a desire from the students to be more involved in the content of their support and to have greater involvement in its design.

The assessment of needs process for adults who require a psychological assessment for dyslexia is an area requiring further exploration. Surveys of learners could take place at various points of the learning journey with a sample of learners across a sample of HEIs to establish how the assessment process is organised. This could also identify whether assessment delay and any subsequent delay in support being organised and implemented is an actual widespread issue and therefore a factor that may significantly affect the learning experience of adult learners with developmental dyslexia on programmes of HE. This may also establish whether there are any provable links between delays of this nature and the attrition of first-year undergraduates with dyslexia on programmes of learning.

A broader evaluation of the models of additional learning support in use across HEIs would be beneficial. This could include surveys of students and focused discussions with support staff in the central disability services within a sample of institutions to test whether the information on the websites is a true reflection of what happens in practice. This could happen alongside a documentary review of the institutional policies for learning support and a survey of the qualifications and expertise

of the practitioners providing this. All of the institutions in the website survey and documentary analysis had a central disability service that suggested that there were specialist staff available who could deliver appropriate packages of learning, but the vast majority had only sketchy details about what this support was for learners with specific learning difficulties (or developmental dyslexia). Only one of the institutions specifically mentioned the use of multi-sensory structured learning programmes, which would suggest that this is an activity that is not common practice across HEIs. A broader evaluation of the models of support practice in use will identify, more fully, what is available, whether what is available is being used and any areas of policy and practice that may need to be reviewed.

An impact research study that plans, implements and evaluates a model of mentoring using mentors as learning peers. A mentoring model should be tested over an extended period of time, perhaps the life of an undergraduate programme, to evaluate whether this could be as beneficial to learning as the evidence suggests. This could be where, much like a laptop, or a tablet, the adult learner with dyslexia is 'attached' to a learning mentor who will remain with him or her throughout the duration of his or her entire programme (ideally). This mentor would be trained in dyslexia awareness/support and could be utilised in teaching and learning situations, examinations and for more general organisational and pastoral support. Initial thoughts on this are for a series of RCTs (parallel design) to be developed to test two mentoring interventions, over two semesters, across three HEI settings to identify any outcomes of statistical significance as a result of the intervention/s. The participants would all hold a formal assessment of dyslexia report (full psychological assessment). Participants would all be on programmes of undergraduate study and randomised experimental and control groups within year and within their own institutions. Participants will ideally between the ages of 18-25 and the sample size would be between 60-80 learners per institution. The study would use intention-to-treat analysis. Mentors would be recruited and trained to deliver 2 interventions in the experimental groups, for example:

1. Interventions for comprehension and long-term recall using MSL methods and lecture materials as a resource.

2. Strategies for the spelling of discipline specific words using a multi-sensory spelling programme.

Outcomes on total correctness measures for both items with the experimental and control groups will assess for any measurable outcomes of effectiveness. For the control group, there would be no intervention. Participants would attend classes as normal (including non-specialist study skills support, if used). The outcomes would be tests of correctness measures for comprehension and for the spelling and application of discipline specific terminology. The hypothesis to be proven or disproven: those receiving the mentoring interventions will perform better than those not receiving the interventions across both outcome measures. CONSORT (2010) guidance will be used to govern the planning, implementation and assessment of the trials. These are outline plans that need further development. It is also worthy of note that there are numerous studies of strong experimental design which have been carried out in education settings outside of HE. For example, work by Khan and Gorard (2012); Gorard, Siddiqui and See (2016) and Gorard, Siddiqui and See (2017) and Younger, Gascoine, Menzies and Torgerson (2018) which provide models of robust interventional study design that could be transferred to other settings such as HE.

In conclusion, there are plentiful opportunities to build on the research in this thesis and for the findings of this thesis to be disseminated to policy makers and practitioners alike. This may go some way to encouraging a positive directional change in this important area of professional concern.

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