# 2. Theoretical Perspectives – a review of selected literature

## Introduction

This thesis is exploring how dyslexia affects academic confidence in university students. Academic self-efficacy and academic confidence stem from the same components of self-efficacy (Sander & Sanders, 2006) proposed by Bandura as core to Social Cognitive Theory (SCT), (Bandura, 1977. 1986, 1997a) which is discussed in some detail. Applying this underpinning theory to university contexts, Sander and Sanders (2003) suggest that academic confidence is thus likely to be a mediating variable that acts between a student's inherent academic capabilities, their learning-style preferences and the opportunities for gaining creditable academic achievements that exist at university as experiences impact on expectations. To gauge academic confidence, the Academic Behavioural Confidence (ABC) Scale was developed as a means to assess students' levels of confidence in their behaviours, actions and plans in tackling their academic study (Sander & Sanders, 2007). The ABC Scale is the metric used in this study with the aim of looking for significant differences in ABC between dyslexic and non-dyslexic students.

However, this section of the thesis opens by reviewing a selection of literature that is germane to the nature of dyslexia. The review is not an exhaustive discussion about how dyslexia has come to be understood through more than a century of research and theorizing, as this is too large a task for this thesis. Instead, it will try to navigate a path through competing theories to highlight some of the tensions, conflicts and contradictions between aetiologies that continue to make research about dyslexia challenging. It will focus on aspects of these which especially impinge on this project and will align the discussion in support of the view that early, definitional paradoxes can now be set aside, in university contexts at least, not least because the most significant of more recent constructions of dyslexia may be challenging whether it makes any sense to be diagnosed as 'dyslexic' at all. These firstly advocate that dyslexia should be best considered as a multifactorial set of characteristics or dimensions, which, although drawing on earlier constructions of dyslexia (e.g.: Castles & Coltheart, 1993), has now attracted significant research interest in the HE sector (e.g.: Tamboer et al., 2016, Tamboer et al., 2017). This approach to understanding dyslexia is to consider its impact on a student's academic progress in a variety of both positive and less helpful ways: for example, it is suggested that innovative and creative thinking may be heightened in students with dyslexia (e.g.: Everatt et al., 1999; Chakravarty, 2009) which might be thought advantageous in some disciplines such as in the Arts, architecture or engineering. In contrast, the frequent use of highly specific and precise terminology in mathematics for example, has been shown to cause difficulties to dyslexic students where similar sounding words – such as ‘integer’ and ‘integral’ - have very different meanings (Perkin & Croft, 2007). Secondly, it has been suggested that more recent thinking about the nature of dyslexia might direct educationalists and especially teaching practitioners towards accepting dyslexia as a wide-ranging set of learning attributes that are positioned along a spectrum of entirely natural, human neurodiversity (Cooper, 2006) but which also acknowledges the atypical nature of this blend of attributes. Although tackling the nature of dyslexia from a different perspective, the neurodiversity approach does allude to multifactorialism as a process for understanding more about what it means to be dyslexic. Hence it can be argued that in order to accommodate both the wider neurodiversity agenda and specifically the multifactorial construction of dyslexia, the focus in learning and teaching environments now needs to shift towards adjusting them in ways that are properly inclusive, accessible and flexible rather than continue to put the dyslexic individual at the centre of the 'reasonable adjustments' agenda because that may reinforce the internalizing of dyslexia as a disabling condition. Hence it is reasonable to assume that a greater accommodation of learning-and-teaching diversity should ameliorate much of the stigma associated with feelings of being different or disabled in learning contexts (Dykes, 2008; Shaw & Anderson, 2018). Lastly, much of the recent literature supports the suggestion that a more useful framework for understanding dyslexia might now exist by considering it as alternative form of information processing (Tamboer et al., 2014) which disassociates dyslexia from disability and difference almost completely. The closing narrative of the first sub-section briefly discusses how dyslexia is assessed or identified in HE contexts and prequels the major part of the study's research design where a new process for gauging dyslexia in university students has been developed as the independent variable in this study which aims to locate the dyslexic individual's learning attributes on a continuum of study and learning dimensions that are observable in any student, either identified as dyslexic or not.

## 2.1 Dyslexia

### I Dyslexia, whatever it is, is complicated.

The contemporary view of dyslexia as it occurs in university students is to consider it as a learning difference rather than a learning disability, although the syndrome remains widely debated (Elliott & Grigorenko, 2014). Attempts to theorize developmental dyslexia and its aetiology differ quite widely (Peterson & Pennington, 2015), not least when attempting to interpret the variety of characteristics that can be presented (Ramus, 2004, Proctor et al., 2017). This is especially so in relation to how cognitive differences, more usually regarded as deficits, are classified as dysfunctions (Buttner & Hasselhorn, 2011) and whether these differences are causal, consequential or even covariates of dyslexia as a learning disability (Vellutino et al., 2004). The impacts of dyslexia and dyslexia-like profiles on learning are readily apparent in literacy-based education systems, ranging from initial identification in early-age learners who experience challenges in the acquisition of reading skills, to university students who attribute many of their struggles to adapt to the independent and self-managed learning processes that are core competencies in HE learning to a dyslexia or dyslexia-like learning profile (MacCullagh et al., 2016).

In the last half-century, attempts to define dyslexia to account for this range of traits have moved away from earlier definitions which focused on dyslexia as a reading impairment in children, more specifically a difficulty in single-word reading fluency and spelling. For example Critchley (1970) provided a brief summary of the historical origins of identifying and attempting to define dyslexia, pointing out that the challenges in arriving at a convincing definition of dyslexia had led some authorities to abandon attempts to do so. Although it is not known which authorities were being referred to, it is reasonable to consider that the reason for this casting-aside could have been due to the plethora of competing definitions of dyslexia that were available to choose between. Drawing on the most recent definition at that time from the World Federation of Neurology (WFN), Critchley supported his point by quoting two, parallel definitions which were recommended for acceptance by neurologists, paediatricians, psychologists and those practicing in the pedagogic domains who perhaps chose the definition that most suited their purposes at the time:

* Specific developmental dyslexia:
  + "A disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of constitutional origin"
* Dyslexia
  + "A disorder in children who, despite conventional classroom experience, fail to attain the language skills of reading, writing and spelling commensurate with their intellectual abilities" (ibid, p11).

It was later suggested that the WFN definitions were inadequate without further defining some of the constituent terms, such as explaining what should be understood as 'conventional instruction' or 'intellectual abilities' for example (Snowling 2002). It was further argued that definitions were weak to the extent that practitioners attempting to use them to determine whether a child was presenting dyslexia or not, were likely to find this a challenge (ibid). Snowling’s reasoning about phonemics being now better comprehended, were thought to be instrumental in understanding dyslexia in children more comprehensively. Phonemics is taken as the study of the sound system of a language and the classification of its phonemes (sound parts). Significant amongst studies drawn upon was a project conducted to explore and explain differences between children who, as poor readers, responded to interventions and remediation, and others of similar intellectual abilities who did not (Vellutino et al., 1996). Amongst the research outcomes of this study were the identification of other apparent deficits which appeared to result from phonological skills differences between 'regular' poor readers and dyslexic children. These were reported as poorer short-term memory performance and rapid-naming deficits, but especially, depressed phonological awareness. This is the ability to recognize how words are comprised of connected sound structures, the ability to distinguish the syllables of a word and particularly to tune in to the individual sounds, or phonemes, of a word. This will be discussed a little more in sub-section 2.1(II) below. Beyond emphasizing the importance of acknowledging phonological processing difficulties as significant in understanding what dyslexia is, Snowling's (2002) discussion proposed that dyslexia should be thought of as more than an issue with literacy. This is demonstrated not least by stating that “dyslexia is [likely to be] characterized by a particular cognitive profile that places a child at risk of reading failure” (ibid, p20), which additionally alludes to the usefulness of profiling in comprehending more about a range of deficits, differences or dimensions which are likely to exist on a continuum as opposed to being discrete categories, a likely development of a similar suggestion proposed some time earlier (e.g.: Ellis, 1985). Much later work by Callens et al. (2012) took cognitive profiling into HE contexts and also into a language other than English through a study of Dutch students, discussed in more detail below (sub-section 2.1(II)). In the Research Design section (3), embracing the dimensionality aspect of dyslexia will be demonstrated in the justifications for designing the Dx Profiler as a tool determining levels of ‘dyslexia-ness’.

It was considered important to bring the definition discussion into the contemporary context of dyslexia amongst university students, and to this end, a straw poll enquiry was conducted as part of the foundations of this current study (see sub-section 3.I(IV) and Appendix 8.1(I)). The outcomes established not unsurprisingly that the definition of dyslexia proposed as workable and understandable by the British Dyslexia Association (BDA) has tended to be the one that has been broadly adopted in HE institutions in the UK over the last decade. This is a definition which acknowledges much of the preceding research evidence but which also takes a more inclusive approach by making no specific mention of deficits, and affirms that some of the traits of dyslexia should be recognized as abilities rather than as disabling:

* "Dyslexia is a combination of abilities and difficulties that affect the learning process in one or more of reading, spelling or writing and may have accompanying weaknesses in processing speed, short-term memory, organization and sequencing" (BDA, 2007).

This definition has since been updated, with the most recent version (BDA, 2018) enshrining the findings of a report commissioned by the UK Government's Department for Children, Schools and Families about identifying and teaching people with dyslexia (Rose, 2009). It is evident that the most substantial changes are in widening the range of characteristics of dyslexia still further, distilling its primary features into a comprehensive, working definition:

* "Dyslexia is a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling;
* Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory and verbal processing speed;
* Dyslexia occurs across the range of intellectual abilities;
* [Dyslexia] is best thought of as a continuum, not a distinct category, and there are no clear cut-off points;
* Co-occurring difficulties may be seen in aspects of language, motor co-ordination, mental calculation, concentration and personal organization, but these are not, by themselves, markers of dyslexia;
* A good indication of the severity and persistence of dyslexic difficulties can be gained by examining how the individual responds or has responded to well-founded intervention." (BDA, 2018)

For the purposes of necessarily grounding a research study in definitions of the principal ideas being explored, it is this BDA (2018) definition of dyslexia that has been chosen as the most appropriate. This is partly because this working definition is quite broad, but also because it includes two important features of the definition that are significant to this project: firstly, referring to dyslexia as a continuum supports the formulation of the Dx Profiler which has been designed and developed for this project to gauge levels of dyslexia-ness along a continuous scale; and secondly, it highlights co-occurring difficulties that are manifested by students with dyslexia at university, and which have been incorporated into the Dx Profiler. These co-occurring issues are discussed in sub-sections 2.1(VII) and 3.1(IV).

Significant in both the original and the current BDA definitions is an absence of any reference to dyslexia as a disability, learning, or otherwise. However, dyslexia is categorized as a disability by the Terms and Definitions of the Equality Act 2010, because the Act considers dyslexia to be a condition recognizable as “a mental impairment that has a substantial and long-term adverse effect on an individual's ability to conduct normal day-to-day activities” (Office for Disability Issues, 2011, p7). Dyslexia is referred to twice in the Guidance Notes (ibid), firstly as an example of a disability which can arise from impairments (Section A5, p9), and later as a condition which may cause an individual to develop coping or avoidance strategies which can fail in some circumstances (Section B10, p19). Translated into the environment of learning and study at university, this means that the premise of the Act supposes that a student with dyslexia - a hidden and not immediately obvious disability which is substantial and long-term - is assumed likely to be a learner who will find the conventional academic processes of university particularly challenging. Setting aside for the moment how dyslexic students may feel about being labelled as disabled, and more especially as ‘mentally impaired’ - which is discussed below in sub-section 2.1(IV) - the first immediate outcome is that such students will be eligible to apply for support through the Disabled Students' Allowance (DSA) in the UK. This a funding stream reserved for disabled students, which provides financial assistance to cover the purchase of equipment, resources and personal support with the aim of ensuring that study at university becomes as fair and equitable as possible in comparison to students with no disabilities. In 2015, the UK Government announced an intention to remove dyslexia as a qualifying condition eligible for consideration under the DSA, presumably because it was considered no longer appropriate to do so given the most contemporary views of dyslexia, despite it being indisputable that dyslexia is long term and persists into adulthood (e.g.: Bruck, 1992; Carawan et al., 2016). As a consequence of lobbying from parent groups, individuals and not least, professional associations such as the BDA and the Association of Dyslexia Specialists in Higher Education (ADSHE) the decision was deferred for the academic year 2016/17, and remains unresolved.

Thus at this time, students with dyslexia that have been identified and documented are able to apply for help with their studies through the DSA. This means that following a formal Needs Assessment, usually conducted by a Disability Needs Assessor either at the student's university or at a specialist centre nearby, a list of recommended equipment and resources is drawn up. Typically this includes a laptop computer with specialist assistive technology software such as an advanced spell-checker or text-to-speech software, and a schedule of personal study assistance, most often study skills support tutorials designed to guide the student towards more easily managing the administrative, clerical and organizational tasks that are an essential part of study at university. However, the Equality Act 2010 also requires universities to provide reasonable adjustments to their physical environment, their operational procedures, curriculum delivery and assessment, and associated academic-related and administrative processes. At a practical level for the student with dyslexia, this typically may mean providing study areas that are differentiated from those more widely available for other students by being located in quieter environments with fewer distractions; ensuring that some computer workstations are equipped with specialist assistive technology applications; that Virtual Learning Environments (VLEs) are formatted to be easy to navigate with content that is easy to access; that additional time may be provided for students with dyslexia to complete formal examinations. Not least this recognizes that in the domain of adult learning at higher intellectually functional levels, (i.e. in HE), early-learning academic challenges that are functions of weaknesses in literacy skills have been shown to be often subsumed by later-learning organizational struggles that impact more substantially on learning confidence. This is in comparison with earlier learning difficulties where processes are developed to circumvent earlier learning weaknesses (Kirby et al., 2008), often through widespread use of study aids and support agencies or technology (Olofsson et al., 2012).

Thus, dyslexia remains a challenging condition to define, with a range of definitions that has emerged over a century of study, largely stemming from an interest in explaining why some children find learning to read particularly challenging in comparison to their peers (Lombardino & Gauger, 2014). For some children this may be through disadvantaged social backgrounds associated with low literacy levels (Snowling, 2012) or a low intellectual ability. But for others who do not appear to bring these challenges to their learning, the slow uptake in reading skills appears to be due to disturbances in elements of the cognitive processing of some sensory inputs (Stanovich, 2000). It is significant, therefore, that in relatively recent research, interest has refocused on gaining a better understanding of subtypes of dyslexia. One study which indicates some of the earlier theorizing about dyslexia from this perspective noted that there appeared to be evidence in developmental dyslexia of the subtypes more normally associated with acquired dyslexia - that is, through brain trauma (Castles & Coltheart, 1993). This suggests that there may be distinct dyslexia factors which may be more, or less prevalent in any single individual who presents dyslexia or a dyslexia-like profile. More recent work has taken dyslexia in adults as a focus and particularly, students in HE settings. Centred in The Netherlands, recent studies by Tamboer and colleagues (in particular Tamboer et al., (2014)) are extending the discussion by building on earlier research that focused on dyslexia as a multi-dimensional condition: Le Jan et al. (2009) explored symptoms of dyslexia in a group of elementary school children (n=113) to build a diagnostic tool based on an analysis of dyslexia characteristics to guide assessors to identify the presence of dyslexia or not. Eight variables from the four categories of metaphonological skills - awareness of the sound structures of spoken words (phonological awareness); awareness of word structures and word inter-relationships (morphology awareness); the visual span of attention in reading (visuo-attentional capacities); and discerning differences in similar sounding syllables, for example between '~ti~' and '~di~' (discerning auditory contrasts). These variables were established as significant predictors of the likelihood of dyslexia being present. Pennington (2006) had previously suggested a multi-factorial cognitive deficit model to explain the causes of dyslexia which emerged from interest in explaining the co-morbidities of dyslexia with attention deficit hyperactive disorder (ADHD) and with speech sound disorder (SSD). One of the key findings suggested that although a multi-variate model did not achieve a thorough understanding of developmental disorders such as dyslexia, ADHD and SDD, it did help in explaining more about the “shared processes at the aetiologic, neural and cognitive levels” (ibid, p405) of such conditions. The focus of the Dutch studies was to explore more fully the factor structure of dyslexia to try to determine firstly whether understanding more about the subtypes of dyslexia can enable more effective screening tools to be developed for identifying dyslexia amongst university students, and secondly whether these are distinguishing features of dyslexic learners alone or they can be observed to varying degrees in other, even all students. This approach in attempting to understand dyslexia and how it might be identified more specifically in tertiary education settings is particularly pertinent to my study (see sub-section 3.1(IV)).

It might be argued that much of the problem in pinning down what dyslexia *is*, is a function of the way in which it is assessed. In the case of the literacy-related dimensions of dyslexia that are most noticeable in young learners, Stanovich in particular has repeatedly questioned the discrepancy approach used to measure dyslexia, insisting that when aptitude-achievement is used as the benchmark comparator, such a 'diagnosis' fails to properly discriminate between attributing poor reading abilities to dyslexia or to other typical causes (Stanovich, 1988, 1991, 1993, 1996, 1999, 2000). Elliott & Grigorenko (2014) brought this into the contemporary context by arguing that identifying dyslexia is so problematic that assessments of it may be irrelevant or at best, academically counter-productive. Notably, it has also been shown that students with dyslexia in HE may not be a homogeneous group due to the likelihood that several subtypes of dyslexia or dyslexia-like profiles may exist. Hence, any identification approaches need to be designed to respond accordingly (Tops et al., 2012). These issues are explored later (sub-section 2.1(VI)), where the discussion specifically expands on the problems and suggested solutions surrounding the determination of the extent of an individual's dyslexia. Hence, given the persistent debate surrounding the nature of dyslexia and which aspects of it might be measurable and for what purpose, assigning a metric to establish a worthwhile appraisal of dyslexia, dyslexia-like characteristics or dyslexia-implied study profiles in learning contexts is ambitious. It is Stanovich's view that domain-specific difficulties - for example, finding reading challenging, struggling with arithmetic - may be comorbid in many cases, but it is only helpful to group such difficulties under an umbrella term - such as 'learning disability' - after an initial domain-specific classification has been established (Stanovich, 1999). This is important, not least because this argument adds weight to the adoption of a factorial view of dyslexia, especially in academically capable adult dyslexics where many of the early-years' learning difficulties may have been displaced by strategically developed learning solutions but which may expose other dyslexia 'factors' as more influential in the learning processes that are commensurate with study at university.

Finally, it is worth observing that the Equality Act (UK) 2010 *attempts* to build on a recognition of the social model of disability, being one that views society as the disabling factor when people are physically impaired or different from most other members of that society. It considers dyslexia to be one of a family of unseen or hidden impairments which are counted as disabilities. But despite the clear intentions of the Act to focus on inclusion and access, dyslexia tacitly remains attributed to the individual, not least through a persistence to ‘diagnose’ it. This position might be argued to be more consistent with the now outdated medical model, where disability is implied to be the fault of the disabled person rather than resulting from situations and circumstances in society that are not adjusted to account for different abilities, either physical or hidden. Much of the research evidence explored and cited in this thesis persists in referring to a diagnosis of dyslexia. This is despite the contemporary view about dyslexia in learning environments more commonly implying that it is the structures and systems of delivery which should be considered as the disabling factor, and that as long as learning outcomes that assess intellect and academic aptitude remain based on high levels of literacy, learning barriers attributable to even a more positively-focused social construction of dyslexia are likely to remain, no matter how the syndrome is defined (Cameron & Billington, 2015). One of the significant outcomes of this study reports on how students learned of their dyslexia to try to find out more about the impact of being diagnosed and how this may be correlated with levels of academic confidence (see sub-section 4.3(II)).

### II Theoretical standpoints of dyslexia

A brief overview of some of the most important theories about dyslexia are now presented. This will not be a discussion or a critical review of the theories, but instead aims to provide a backdrop of the main ideas about dyslexia as a framework that, together with the theoretical underpinnings of academic confidence presented later (sub-section 2.2), support the objectives of this current study.

Theories about dyslexia fall into several, broad categories: Attributing dyslexia to phonological skills and awareness differences is widely researched and supported, not least due to relevance in explaining reading difficulties in children. Explaining dyslexia as an outcome of visual differences or irregular visuo-attentional processing appears at the outset to be quite different and sometimes rather specialized, but these theories have also attracted substantial support. A more recent focus considers dyslexia as an example of natural human neurodiversity by placing it along a spectrum which is said to include, for example, autism and Attention Deficit Disorder (ADD). Other theories have tried to blend some of the well-substantiated explanations into a more comprehensive framework for understanding dyslexia by taking a neuro-biological standpoint; or to consider it as a multifactorial syndrome that presents a wide range of characteristics, attributes and differences, not only in learning and study behaviours but also more widely in everyday functioning. These will be taken in turn in an attempt to crystalize the most important features of each into short overviews, to briefly illustrate their theoretical roots and how they may be located in the domain of learning and teaching, especially in HE contexts.

*1. Dyslexia is a phonological processing disturbance*

This is a major theory of dyslexia, offering the explanation for reading difficulties as resulting from impairments in forming grapheme-phoneme correspondence: that is, understanding the connections between the forms of letters and the corresponding sounds that are represented. More specifically, that the ability to blend or disassemble letter combinations, i.e., syllables and words, into or from their corresponding speech sounds is impaired (Brady & Shankweiler, 1991). In the phonological-core variable-difference framework, Stanovich (1988) argued that the primary difference between dyslexic and non-dyslexic individuals is evidenced by a deficiency in the cognitive dimension where phonological skills are located. This was said to explain differences in causes for delayed reading skills’ acquisition between young people with a dyslexia and others who were more of the 'garden variety' of poor readers (ibid, p590), a term originally coined by Gough & Tunmer (1986) in a study about decoding, reading and reading disabilities. The idea is based on the argument that an individual with dyslexia has a cognitive deficit that is by-and-large, specific to reading. Were deficits to extend more widely into other cognitive areas of functioning, then such an individual would not be dyslexic but rather, a 'normal' poor reader. The most important point is Stanovich's contention that in dyslexia, the deficit is vertical in respect to the individual's inherent cognitive powers, and hence is domain-specific. This is in contrast to a more horizontally manifested deficit, which would be presented as extending across several cognitive domains. These might be attention and concentration, or visuo-spatial skills. This standpoint goes some way towards explaining why much of the earlier dyslexia research is rooted at the word-recognition level of phonological processing abilities. These are abilities which may include phonological decoding, inefficiencies in short-term memory processes, or in translating the written representation of phonemes into their correct sound segments, for example in properly distinguishing the vowel sound differences that are centrally located in (English) words such as b**oa**t, b**oo**k, b**oo**t. This difficulty impacts progressively when children advance from learning the individual sounds of letters and short letter combinations into blending these into words and hence challenges the development of reading skills, indicating that the link between phonological processing and acquisition of reading skills is causal (Wagner & Torgesen, 1987), although later research suggested that this relationship may be bi-directional. That is, it may equally be the actions of learning to read which enable phonological awareness (Hogan, et al., 2005, Brunswick, et al., 2012). However, the most important point is that although phonological deficits may also occur in non-dyslexic poor readers, their deficits may also extend into other domains (Stanovich, 1994).

But why do phonological processes impact so much on reading? It is beyond the scope of this thesis to engage with lengthy discussion about the components and processes that drive the acquisition of reading skills but the core idea of 'phonics' as a learning-to-read procedure is that it teaches children to match up the sound components of words with individual letters or letter groups, and consequently is also directly related to the simultaneous acquisition of spelling competency. For example, children will learn that the sound ‘***k’*** can result from a variety of letter or spelling sources: ***c***, ***k***, ***ck***, or ***ch*** (in English). In reverse, being able to spot letters and letter combinations in new words being learned enables a reader to decode the word into its component sounds and hence reconstruct the sound of the complete word. It follows therefore, that disturbances which affect any or all of these letter-sound coding-decoding processes will impact on a child's ability to convert text into speech whether out loud, in the learner’s mind, or into writing. Essentially, this is the core of phoneme-grapheme-phoneme correspondence. Interference in this process is likely to be evidenced where children’s' reading, spelling and writing skills fail to develop, principally in comparison with their peers and to expected levels of progress when taking into account other significant factors such as their inherent academic ability, socio-environmental or cultural factors. Hence a key advantage of considering dyslexia as principally identifiable through core phonological deficits (Stanovich, 1986) is that it is relatable to what is commonly understood about the typical acquisition of reading skills (Snowling, 1998) and corresponding competencies in spelling and writing. Assessing individuals' capabilities in these key literacy skills through properly-developed, well-established norm-referenced, procedures can be significant contributors to a dyslexia-identifying process, because the primary problem of reading-impairment in dyslexia is one of word recognition caused through weak phonological coding competencies (Stanovich, 1996).

However, understanding how phonological skills, reading writing and spelling, and dyslexia are interrelated is not in research stasis. Although it is fair to say that ideas continue to develop and evolve rather than emerge, such evolutions are incrementally advancing what is known about how reading and other literacy skills are acquired in the first place, and how these skills acquisitions might be adversely affected by disturbances that are inherent in some individuals, either attributable to dyslexia or to something else. As if this may not be challenging enough, it is compounded by rightly taking account of socio-environmental factors that have been shown to significantly impact on the development of literacy skills in early years, and finding out more about how these factors need to be accounted for in experimental design and research outcomes. For example, because pre-literate early learners' phonological skills develop out of auditory experiences, it follows that immersion in high-quality oral experiences at home and pre-school is likely to enrich and more readily enable these skills (Goswami, 2008). Conversely, it is reasonable to suppose that social disadvantage or deprivation is at the very least likely to delay the typically expected development of phonological skills, and hence competencies in literacy in early-years learners (Law et al., 2011). Amongst many, three important factors can be distilled as pertinent to this thesis: firstly that there is evidence that some individuals are not dyslexic ***enough*** for early-learning phonological deficits to have had a lasting impact on their literacy skills, and that it may be other characteristics of their dyslexia which emerge as debilitating in later learning (Ramus & Szenkovits, 2008). Secondly, some adults with dyslexia who had significant phonological deficits as children appear to have ‘recovered’ when these skills are re-assessed in adulthood (Goswami, 2003) either through the development of strategic compensations, or that their dyslexia has apparently ‘gone away’, which, on the basis of dyslexia being understood as a neurobiological condition or even as a neurodiverse situation, seems unlikely. Lastly, renewed interest in viewing dyslexia as a multidimensional condition (discussed below) as a way to explain the diversity of behavioural symptoms and also to bind together some of the more significant theories, is particularly enabling progress to be made in understanding how dyslexia impacts on adults’ engagement with learning in HE contexts.

*2. Dyslexia is attributable to visual disturbances*

Before the phonological processing theory of dyslexia emerged, dyslexia or *word-blindness* (Hinshelwood, 1896; Pringle Morgan, 1896) was thought to be primarily a visual processing defect which resulted from impairment of the visual system. This notion was later developed by Orton (1928) who coined the term ‘strephosymbolia’ to describe the tendency of some dyslexic readers to reverse letters (e.g. ‘b’ and ‘d’) and to swap the order of letters within words (so ‘was’ might be read as ‘saw'). Later still, Stein (1991) linked instabilities in binocular vision - which may create issues in visual tracking both across lines of text and from line to line – with impaired reading development (see also Bellocchi et al., 2013). Whilst it might be supposed that such physiological disorders may appear unrelated to cognitive functioning from the phonological processing point of view of dyslexia, issues in following printed text accurately will make the reading and comprehension of it difficult, and hence may present similar symptoms of poor reading. Amongst others, Kirby and colleagues (2011) suggest that vision differences are likely to be the most significant underlying causes of dyslexia. This may, however, indicate a misunderstanding about how visual disturbances may be a factor in a dyslexic profile, and indeed, not necessarily a component in all dyslexic profiles. Stein and Walsh (1997) considered that a major issue in dyslexia is difficulty processing fast incoming sensory information effectively, whichever sensory domain it comes from. It is beyond the scope of this thesis to expound the details of the brain’s visual system other than to summarize that magno cells, or M-cells (located in the thalamus), are part of the visual cortex of the brain that detects orientation, movement, direction and depth, and which directs eye movements to enable individuals to maintain steady fixation on a visual target. Research has shown that in some dyslexic readers’ brains, M-cells are significantly smaller and more disorganized than those in the brains of non-dyslexic readers (Livingstone et al., 1991, Galaburda & Livingstone, 1993). It follows, therefore, that weak or abnormal development of this sub-structure of the brain will account for some reading challenges, especially in the early development of reading skills where clear perception of the orthography of a written language is key to comprehending the relationships between words and their sounds and meanings (Stein, 2001). The greater picture that relates dyslexia to visual disturbances through the magnocellular theory remains controversial, although research building on the earlier foundations of Stein continue to indicate that visuo-attentional processing issues may be at least one of the components of developmental dyslexia (Bellocchi et al., 2013). It is notable however, that visual differences described as jumping letters, fizzing text and dancing lines, although common in many individuals with dyslexia, are equally absent in others (Shovman & Ahissar, 2006), with another study reporting that in assessments of visual target detection, dyslexic readers' performance showed no difference in comparison to that of non-dyslexic readers (Hawelka & Wimmer, 2007).

The issue may be further conflated because other less fundamental visual disturbances can also impair access to print. Of these, visual stress (ViS), scotopic sensitivity, or Meares-Irlen Syndrome (MIS) may be examples of distinct but possibly related conditions that sometimes occur alongside dyslexia rather than are indicators of the syndrome. Typically presented as heightened sensitivity to lighting glare or contrast differences, other vision issues can also make reading challenging. These can include restricted fields of vision, which make only small areas of text become properly in focus, or challenges in maintaining focus on text for a sufficient time to properly enable comprehension (Irlen & Lass, 1989). Visual stress has been shown to be more of a visual processing issue rather than an optical dysfunction which can occur widely rather than specifically amongst individuals with dyslexia (Wilkins, 1995). Claims that MIS may have higher levels of prevalence amongst individuals with dyslexia than in the general population (Singleton & Trotter, 2005) are difficult to verify, not least because evidence more usually points towards dyslexia and MIS being comorbid conditions rather than causally related (Kruk et al., 2008), although either way, this may suggest that a higher prevalence of these conditions might be expected amongst dyslexic readers. Kriss and Evans (2005) supported this comorbidity idea but found that there was only a slightly higher prevalence of MIS amongst individuals with dyslexia in their study in comparison to their control group. Another recent study exploring dyslexia in a substantial sample of French schoolchildren (n=275) found that those who presented comorbid phonological and visual deficits did not show a more significant reading disability than those with phonological deficits alone (Saksida et al., 2016). Nevertheless, assessments of visual stress have been frequently included in dyslexia screening tests in recent years (Nichols, et al., 2009) and their use is common in educational contexts to ameliorate vision differences, notably in universities (Henderson et al., 2014). Placing tinted colour overlays on to hard-copy text documents and use of assistive technologies that create a similar effect for electronic presentation of text to relieve some of the symptoms of visual stress have been long-standing recommendations in students' Disabled Students' Allowance Assessment of Needs, indicated by anecdotal evidence at least. However, evidence that this solution for remediating visual stress is more useful for those with dyslexia than for anyone else who experiences MIS or ViS is variable (e.g.: Henderson et al., 2013; Uccula et al., 2014). Ritche et al. (2011) found that coloured overlays had no significant or immediate effect on reading ability in poor readers although their sample was small. Their conclusions were endorsed however, by a significant review of a substantial number of studies, which concluded that apparent improvements in reading fluency as a result of the use of coloured overlays may be more likely due to placebo, Hawthorne and novelty effects (Griffiths et al., 2016). Even more significantly, one study found that use of overlays can actually be detrimental to reading fluency, particularly in adults (Denton & Meindl, 2016). Thus although the relationship between dyslexia and visual stress remains unclear, there is evidence to indicate that there may be an interaction between the two conditions which can have an impact on the remediation of either (Singleton & Trotter, 2005) and even though measurable improvements in reading fluency in individuals with dyslexia through use of coloured overlays or assistive technology applications that do the same may be difficult to attribute to anything other than the placebo effect, if students feel that they are gaining benefits, this alone builds an argument to support their continued use.

*3. Dyslexia is a rapid auditory processing disturbance*

This theory takes the view that the specificity of the difficulties in phonological awareness and processes are secondary to more fundamental issues with auditory processing. Pasquini et al. (2007) outlined several auditory impairments that had been suggested as contributing to phonological processing difficulties, and that as a result, offer another dimension to explanations for reading difficulties. These were auditory impairments most specifically related to deficits in the perception of short or rapidly varying sounds (cf Stein and Walsh’s earlier work on the processing of fast incoming sensory information). Early work examining auditory discrimination capabilities between reading-impaired and control children had found a strong correlation between errors in nonsense word reading (to assess phonics skills) and errors in responding to rapidly presented auditory information (Tallal, 1980). This led to an hypothesis that some reading difficulties may be linked to low-level auditory perception disturbances, affecting the ability to learn to use phonics skills. Subsequent studies also found evidence amongst dyslexic children for poor auditory discrimination of certain sound contrasts in phonemes such as '~ba~' and '~pa~' (Adlard & Hazan, 1998; Serniclaes et al., 2004; Goswami et al., 2011). In characterizing dyslexia by unexplained difficulty in reading, Temple and colleagues used functional MRI with a group of children (n=32, dyslexic and non-dyslexic) to firstly confirm earlier studies which had indicated neural differences during phonological processing between dyslexic and the non-dyslexic individuals (e.g.: Temple et al, 2001), and secondly to show that a remediation programme which focused on auditory processing and oral language training was able to ameliorate disrupted neural function in brain regions associated with phonological processing (Temple et al., 2003). But the relationship between auditory differences - whether these be classified as impairments, deficits or dysfunctions - and dyslexia remains a debated topic although it is reasonable to suppose that firstly, individuals who present with auditory processing challenges are likely to see these impact on their phonological awareness; but secondly, that care must be taken to understand the distinction between auditory impairments and auditory *processing* impairments, where the first is concerned with the physical capabilities to hear sounds and the second is about how accurately acquired acoustic information is subsequently interpreted by the brain. Although both seem distinctly but equally likely to impact on the development of phonological skills and hence reading abilities (Witton & Talcott, 2018), is it beyond the scope of this study to consider these more deeply.

*4. Dyslexia results from a mildly dysfunctional cerebellum*

Emerging from earlier research grounded in an automatization deficit theory where individuals with dyslexia were found to have reduced performance in comparison to controls on tasks where balance had to be maintained whilst undertaking another task (Nicholson & Fawcett, 1990), the cerebellar deficit theory of dyslexia (CDT) was extended to include issues related to time estimation that were said to be reduced in dyslexic children (Nicholson et al., 1995). These ideas were consolidated into an hypothesis for the cause of developmental dyslexia arguing that disorders of cerebellar functioning, presenting as reading and writing difficulties, may be a factor in the explanation of dyslexic learning differences. (Nicholson et al., 2001). This idea is interesting, not least because it attempts to relate the major behavioural symptoms of dyslexia in children at least, to issues with automaticity in linguistic capabilities which need to be refined to enable fluent reading - and associated comprehension - writing, and spelling. Figure 1 provides a summary of the logic of the theory, showing how features of cerebellar impairment and functioning might explain typically presented characteristics of dyslexia. The theory also offers explanations in part at least, for the higher-than-normal predisposition towards weaker motor control competencies sometimes observed in dyslexic children (Fawcett & Nicholson, 1995). Whether this is evidenced by poor hand-writing in children with dyslexia may be uncertain, where although one study demonstrated reduced handwriting competencies in dyslexic children (Mattlew, 1992) further evidence is sparse. Another study identified that one reason why dyslexic children appear to be slower writers than their non-dyslexic peers could be attributed to them pausing more often during their writing processes, which was found to be related to their spelling competencies (Sumner et al., 2013). This is a link not established in Nicholson & Fawcett's (2001) model. The CDT process chain does, however, also provide an acknowledgement of the phonological awareness issues associated with dyslexia by including these into the theoretical representation through what is termed the 'word recognition module' as a precursor to reading and spelling. Critics of the theory have had difficulty in reproducing the earlier evidence of compromised automaticity in the dual-task balancing experiment with children with dyslexia, where results suggested a confounding factor between dyslexia and ADHD and that this may have unknowingly compromised earlier findings (Wimmer et al., 1999). A screenshot of a cell phone

Description automatically generatedFurther, Ramus et al. (2003) were only able to provide partial support for the cerebellar deficit theory, finding that only half of the dyslexic children in their study presented any significant motor control challenges and that no evidence was found which linked motor skills to phonological and reading skills. However, their study did concede that those with dyslexia, as well as those with other developmental disorders (including ADHD), may evidence greater challenges in activities that reqjuire finer motor control skills than may be witnessed in children who are not affected by such disorders.

Figure 1: Process chain indicating components of the cerebellar deficit theory of dyslexia (adapted from Nicholson et al., 2001, p510).

5. Dyslexia is a manifestation of natural human diversity:

An alternative viewpoint about the nature of dyslexia constructs the syndrome in the context of 'neurodiversity'. The BRAIN.HE project (2005), now being revised but with many web resources still active and available, hailed learning differences as a natural consequence of human diversity, and suggested that dyslexia is amongst so-called 'conditions' on a spectrum of neuro-diversity which includes ADHD and Asperger's Syndrome (Pollak, 2009). This view supports the argument that individuals with atypical brain 'wiring' are merely at a different place on this spectrum in relation to those others who are more 'neurotypical'. The greater point here is well put by Cooper (2006), drawing on the social-interactive model of Herrington & Hunter-Carsch (2001), with the idea that we are all neurodiverse and that it remains society's intolerance to differences that conceptualizes 'neurotypical' as in the majority. This may be particularly apparent in learning contexts where delivering the curriculum through a largely inflexible literacy-based system discriminates against particular presentations of neurodiversity (e.g.: Cooper, 2009). One of the most significant features of the neurodiversity approach towards understanding dyslexia is a fundamental recognition of the syndrome's strengths in many areas of human functioning as well as acknowledging weaknesses in others. Armstrong (2015) argues that this means taking a more judicious approach to identifying and labelling cognitive or mental differences as disorders or disabilities, especially in the domain of education and learning. Further, that curriculum provision should be adapted in ways that enable and empower the neurodiverse student to flourish rather than be identified as different from their peers, not least through removal from mainstream into differentiated learning situations (Armstrong, 2012). It is notable that this construction of dyslexia resonates with the concepts of Universal Design for Learning, outlined earlier, and below (sub-section 2.1(III)).

6. Describing dyslexia using a multifactorial approach:

A significant body of recent work has attempted to understand dyslexia using a multifactorial approach, largely built on an early study (Castles & Coltheart, 1993). This argued that attempts to understand the aetiology of dyslexia using a phonological deficit model, or alternatively, where the observed symptoms were physiological and principally vision-related, were simplistic. Therefore, a more comprehensive perspective, based on the acceptance that dyslexia may be a *variable* rather than a *determined* learning circumstance, may be a better model. Although this study focused on reading deficiencies in children and took no account of wider differences in learning approaches that are now known to be apparently associated with dyslexia in adult learners, the study was important because even within the scope of its focus, it appeared to identify two distinct subtypes of reading difficulties with one accounted for by deficits in whole-word recognition whilst the other by deficits in gaining a good grasp of letter-to-sound rules (ibid). This is important because the conclusion was that individuals, (that is, children, it is assumed), who present developmental dyslexia do not form a homogeneous group. Therefore, it is reasonable to argue that different varieties of dyslexia are likely to exist, all distinctly characterised by a different blend of 'deficits' in comparison to the 'norm'. A later study, which did not appear to draw on this work by Castles and Coltheart, but where the outcome certainly adds value to their work, took a logical deductive approach to argue that dyslexia is a multifactorial condition, where any number or combination of *causes* can lead to the same outcome. Therefore it follows that dyslexia should be best considered as a ‘multiple deficit’ syndrome (Pennington, 2006). One study that *was* considered in a brief review of prior research on dyslexia as a multiple deficit syndrome identified it as being characterised by a ‘weighted profile’ of deficits (Vellutino et al., 1991). Weighted profile in this context is cognate to the concept of a weighted mean average in statistics. This is pertinent to this current study because the research design (see Section 3) also adopts the weighted profile approach to describing the blend of dimensions which constitute a learning and study behaviour profile of university students ascribed a level of dyslexia-ness.

A later study of dyslexia in French schoolchildren highlighted that it may be possible to identify dyslexia on the basis of several, apparently independent cognitive variables without assessing reading or spelling deficits (le Jan et al., 2011). This was shown to be achievable by building a predictive, multivariate model of variables drawn from cognitive categories which included memory, visual-attention span, selective attention and auditory components. This is interesting because it detaches some of the basic literacy-skill dimensions from an identification process for dyslexia, and concentrates instead on alternative attributes of the syndrome, not least drawing from some of the theories outlined above. This is arguably the most appropriate focus to adopt for understanding dyslexia in HE where, in generally academically capable university students, anecdotal evidence at least, suggests that many early literacy issues can have been partially mitigated, either through individual strategic management of them, or through use of assistive technologies. Furthermore, studies with Dutch university students ‘described’ dyslexia (as opposed to ‘diagnosed’ it) in adult learners at university using five factors determined through a principal component analysis of a wide range of dyslexia dimensions (Tamboer et al., 2016). This is pertinent because it shows how useful factor analysis can be as a mechanism for identifying families of independent dimensions that together, might be an effective identifier of dyslexia in certain circumstances. The process had also previously been used to identify latent variables (i.e. factors) in a study exploring phonological and visual-attention differences in French and English children (Bosse et al., 2007) and on differences in rapid automized naming tasks in Italian children (Di Filippo & Zoccolotti, 2012). But secondly, demonstrates that in HE contexts, self-report questionnaires can serve as reliable identifiers of dyslexia in university students (Tamboer et al., 2014), This was a fact also suggested by Chanock et al. (2010) in their appraisal of a standard battery of diagnostic tests for dyslexia which they had found to be lacking in both sensitivity (correctly detecting dyslexia in known dyslexic students) and specificity (detecting dyslexia correctly in non-identified students), where their own, self-report questionnaire performed better for both parameters. As will be described later (Section 3), both of these elements of research design - using a self-report questionnaire to gauge dyslexia, and principal component analysis of dyslexia dimensions - are key to addressing the research hypotheses being examined in this current study.

Additional, interesting features also emerged from Tamboer and colleauges’ (2016) study, not least their interpretation about how to measure the *severity* of dyslexia, and why to do so might be meaningful. Dyslexia severity was determined through a logistical regression analysis that classified the students in their sample (n=446) without considering which factors of dyslexia were to be taken as more significant than others. In this way, it was possible to sub-divide their sample into three, distinct subgroups: students with dyslexia; students with a very low likelihood of dyslexia; and thirdly, students who brought with them no prior diagnosis of dyslexia but who were presenting many of the characteristics of dyslexia typically associated with formally identified dyslexic university students. This also resonates with the research design in this current study where 'severity of dyslexia' is interpreted as a 'level of dyslexia*-*ness', and the design relies on establishing three subgroups of students, defined similarly: dyslexic students; non-dyslexic students; *quasi*-dyslexic students – equivalent to the third subgroup in the Tamboer study. Finally, it is apposite to report the nature of the five factors established in Tamboer's studies due to the similarities between these, and as will be reported later (in Section 4), the factor analysis applied to the data collected in this study which also identified five factors of dyslexia that made sense in university-learning contexts. Tamboer’s five factors were distinguished as: spelling; phonology; short-term memory; confusion; and complexity; determined through a reduction of 17 dyslexia dimensions, whereas for the data collected in this study’s similar sample of university students (n=166), the factor analysis reduced 20 dimensions into five factors designated as: reading, writing, spelling; verbalizing and scoping; working memory; organization and time-management; and thinking and processing.

Further work consolidated these Dutch studies into a dyslexia screening tool designed for use with university students or more widely with adult learners (Tamboer et al., 2017). The screener built on the power of factor analysis to generate components of dyslexia which appear to be stable and robust discriminators, and also strongly relied on the contribution of a self-report questionnaire to the final outcome of the screener, which was reported to have a high construct validity and a predictive validity that was even higher than that of the screening tool's tests (ibid). Both of these findings augured well for the research design for this current project. Significant due to its similar focus, and also arising out of work with Dutch university students, are other studies which have searched for better screening tests for dyslexia in HE contexts. Notable amongst these, Tops et al. (2012) conducted a study which took the novel approach of pairing dyslexic and non-dyslexic students as the means to establish Test and Control group data and they administered a large number of verbal and non-verbal tests to establish comparisons across the student-pairs. The aim was to discover which tests were the most valuable to include in a dyslexia screener by having the most effective discriminative power. Where this is interesting and pertinent to this current study is twofold: firstly, and contrary to the findings of Tamboer's studies reported above, Tops and colleagues arrived at just three sub-tests in their proposal for an effective screener which were all components of reading-writing skills: word reading; word spelling; and phonological awareness. Secondly, the research analysis processes of that study also added substance to the research design of this current project, notably because analysis was focused on a correlation matrix of effect sizes. A similar process has been adopted in this current study, not least as a means to understand more clearly the significance of interrelationships between factors of dyslexia and factors of academic confidence. Hence, the study by Tops et al. (op cit) sets a useful data-analysis precedent and although the sophistication of their statistical processes stretches beyond this current study, it nevertheless indicates that the approach being adopted broadly follows a precedent. Finally it should be acknowledged that Tops et al. emphasized that although the three tests their study proposed as sufficient to provide the necessary discriminative power for identifying a possible dyslexia in a university student, they were not suggesting that these were the *only* areas where significant differences between dyslexic and non-dyslexic students were apparent in HE. Nor was their study pointing to the causes of dyslexia, rather, the focus was on the predictive capacity of the screener. The stance of the study tacitly questioned the relevance of a dyslexia-identifying process at university, by leaving as ‘open’ the purposeful value of such a process, especially since a substantial proportion of students with dyslexia in their datapool had attributes and characteristics (i.e. deficits) which deviated significantly from the general pattern. This is concurrent with the continuing challenges that prevail in establishing a concrete definition of what is meant by 'dyslexia', not least because this may be context dependent. It also alludes to the idea that rather than persist with a focus on identifying individuals whose profiles are atypical so that compensations might mediate their differences, adjusting their learning environment in ways which would enable them to be more readily accommodated would be preferable.

Binding theories of dyslexia together – Frith’s model:

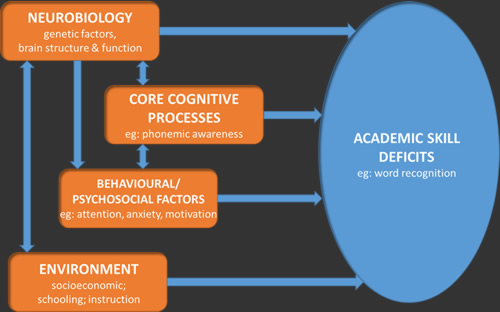
Before moving forward to a wider discussion about the impacts of dyslexia on individuals, and particularly the ways in which the syndrome affects their capabilities to engage effectively with learning, it is useful to reflect briefly on Frith’s (1999) causal modelling framework which endorsed earlier work arguing that dyslexia should be considered as a syndrome, characterized by a wide diversity of symptoms, indicators, dysfunctions, differences and challenges; these are typically exposed when individuals both young and not-so-young engage in learning activities. Taking the standpoint that dyslexia is a neurobiological condition, Frith suggested that this means blending together three broad churches of theoretical postulation: 1. Dyslexia is a biological condition because it has a basis in the brain and that there are genetic, heritable factors which, to some extent, demarcate the dyslexic brain from the non-dyslexic one (also: Pennington, 1990; Ohlson et al., 2014; Swagerman et al., 2017). 2. Dyslexia is representative of cognitive differences which are frequently demonstrated by measurable anomalies in information-processing capabilities in comparison to standardized norms, for example in assessments of working memory (e.g.: Jeffries & Everatt, 2004) however it has been shown that understanding the impact of dyslexia on working memory is complex, not least because it depends on which domains of memory capabilities are assessed (Pickering, 2012), or of phonological skills (e.g.: Rack, 2017) when compared with the range of competencies observable in the majority of people. 3. Dyslexia may be evidenced principally by early learning-behaviour differences, not least delay in acquiring early reading skills in comparison to peers, and by associated weak spelling competencies (e.g.: Stanovich, 1994). These three levels of Frith's framework are suggested to be, if not bound together by, then at least linked by environmental factors, which can both contribute to and be influenced by each or all of the biological, cognitive and behavioural factors. For example, in supporting a university student to develop an effective strategy for becoming more systematic in searching for information resources, although this may become a mechanism to facilitate greater methodical effectiveness, it may also be a remediation of the *symptom* of being muddled and disorganized rather than a 'cure' for the underlying difficulty, which may have its roots in the student's dyslexia. Conversely, an explanation for a child who is a poor reader might be attributed to elements in the child's socio-cultural background such that the typical early comprehension of the alphabet may have been delayed, being an environmental factor and nothing to do with dyslexia at all. The most important idea to emerge out of Frith's analysis is that to focus on any one of the three levels to the exclusion of the others in an attempt to explain dyslexia would be erroneous and unscientific, flying in the face of substantial evidence accumulated from a range of studies of dyslexia at all three levels. Ramus (2004) extended Frith's framework by carefully reconsidering earlier neurobiological data to suggest that not only can the model be used to bring together the phonological and magnocellular (vision differences) theories of dyslexia, but that it may also be applicable to other functional differences observed, for example, in developmental dyscalculia and in ADHD. Fletcher et al. (2007) appear to have adapted Frith's model to visualize the competing/contributory factors that can constitute a dyslexic profile by focusing on not only the integrability of Frith's earlier three factors, but also heightening the bidirectional relationship between neurobiological and environmental factors (Figure 2). Fletcher's adjustments of Frith's model indicate the view that cognitive processes and behavioural and psychosocial factors are within the envelope of the neurobiology of dyslexia, with ‘the environment’ as more discretely related. This is a only a subtle re-interpretation, as Frith's original model implies these to be sequentially organized strata which were placeholders for the various component parts of a dyslexia causation process. For example, in describing dyslexia as a phonological deficit, the causal chain may start in the 'biological' layer by suggesting a left brain hemisphere disconnection as the root, leading to a phonological deficit in the cognitive layer which generates poor phoneme awareness as one of the behavioural characteristics. It is acknowledged that there is more to it than this, notably that genetic disorders are said to account for the biological level in the model having only one node (Morton & Frith, 1995). Embracing this causal chain are environmental factors such as teaching methods and literacy values (Frith, 1999, p203). Fletcher’s interpretation is useful because it directly indicates the outcome of the causal factors as academic skills deficits that be be observed in dyslexic learners.

Figure 2: Competing/contributing factors which may constitute a dyslexic profile (adapted from Fletcher, 2009, p511)

Finally, it is of note that attempts have been made to compare and contrast the competing theories of dyslexia with an intention to explore whether they may be conjoined into a single, broad explanation for dyslexia rather than to favour one theory at the expense of the others. For example, Ramus et al. (2003) conducted an intriguing case study with a small group of 17 dyslexic university students and a control group of 17 students with no indications of dyslexia. The aim of the study was to evaluate dyslexia from all of the major theoretical perspectives to explore associations or dissociations which may imply causal relationships between the characteristics widely observable in individuals with dyslexia. A significant factor of the research design was the recruitment of academically capable adults as research participants. Although such individuals are not likely to be representative of the wider population of adults with dyslexia, by virtue of their intelligence, likely resourcefulness, possible social privilege, and that they may have benefited from good quality help with their early reading difficulties, the research is relevant to this current study due to its focus on university students as the participants. The tests used in the study were extensive, and devised to generate a comprehensive neuropsychological profile of the participants by cataloguing the outcomes of psychometric, phonological, auditory, visual and cerebellar evaluations. However, the results revealed no significant relationship between auditory and phonological deficits despite a strong correlation between these domains' data. In the dyslexic group a greater diversity of outcomes was recorded in auditory assessments, whereas more uniform results were obtained across the group in the phonological tests. The conclusion was that auditory performance is not a predictor of phonological performance. Overall, the study re-affirmed the widely held view that the most significant issue for individuals with dyslexia is in phonological skills with impaired capabilities being observed in all of the students with dyslexia. The incidence of deficits in the other components were variously observed in the dyslexic students in the sample, leading to a conclusion that some of these are not so much causes of phonological deficits but may aggravate them. Thus, this study is important partly due to the significance of its research design as a comparator of the major theories of dyslexia but also because it deliberately took dyslexia in university students as the focus which resonates with the project being reported in this thesis.

### III Equitability in learning systems – accommodating dyslexia?

From sketching out an overview of the main theories about dyslexia, this sub-section now considers briefly how students with dyslexia are accommodated in learning systems. This is important because by first understanding more about how such students are ‘managed’ at university, this leads to a discussion (below) about the impact and stigma of learning differences labelling, and how this, and the processes used for identifying dyslexia may impact on those students being assessed.

Both 'difficulty' and 'disorder' are loaded with negative connotations that imply deficit, particularly within the framework of traditional human learning experiences and curriculum delivery environments that remain predominantly 'text-based'. This is despite the last decade or two of very rapid development of alternative, technology or media-based delivery platforms, embraced by an information society that sees news, advertising, entertainment and 'gaming', government and infrastructure services - almost all aspects of human interaction with information - being delivered through electronic mediums. And yet formal processes of education largely remain steadfastly text-based which, although now broadly delivered electronically, still demand a conventional ability to properly and effectively engage with the printed word, both to consume knowledge and also to create it or to demonstrate understanding. This persistently puts learners with dyslexia - in the broadest context - and with dyslexia-like learning profiles at a disadvantage and hence is inherently unjust. Cavanagh (2013) highlights this tardiness in the delivery of education and learning to keep up with developments in information diversity by candidly observing that the fields of pedagogy and andragogy should recognize that, rather than learners, it is curricula that are disabled, and hence need be adjusted.

Cavanagh is one of the more recent proponents of a forward-facing, inclusive vision of the barrier-free learning environment which is the Universal Design for Learning (UDL) (Rose & Meyer, 2000). UDL is attempting to tackle issues of justice in learning in ways that would declare dyslexia as at worst, a learning difference amongst a plethora of others, rather than a learning deficit, difficulty or disability. As such, it is aligned with the construction of dyslexia as an example of neurodiversity outlined briefly above (sub-section 2.1(II)). With its roots in the domain of architecture and universal accessibility to buildings and structures, the core focus of UDL is that the learning requirements of all learners are factored into curriculum development and delivery so that every student's range of skills, talents, competencies and challenges are recognized and accommodated without recourse to any kind of differentiated treatment to 'make allowances'. Hence it becomes the norm for learning environments to be much more easily adaptable to learners' needs rather than the other way around. This will ultimately mean that the text-related issues, difficulties and challenges that are undoubtedly due to deficits in some individuals and which can adversely impact on their successful engagement with conventional learning systems, will cease to have much impact in a UDL environment. There is an increasing body of evidence to support this transition in learning design, not least through attention being focused on the learning-environment challenges facing different learners. This ranges from building in equitable accommodation of learning difference into the exciting new emphasis on developing STEM education (e.g.: Basham & Marino, 2013), to designing learning processes for including all students into health professions courses (e.g.: Heelan, et al., 2015). However, other measures remain necessary to ensure an element of equitability in learning systems that fail to recognize and accommodate learning diversity. One route that outwardly seems attractive, draws on the idea that matching teaching approaches to students' learning preferences has merit. Extensive earlier, and recently revisited research on learning styles has demonstrated that when teaching styles are aligned with student learning styles, the acquisition, retention and later re-application of knowledge, can be more effective, fosterering better learning engagement (Felder, 1988; Zhou, 2011; Tuan, 2011; Gilakjani, 2012). Moreover, a mismatch between teaching, and learning styles can cause learning failure, frustration and demotivation (Reid, 1987; Peacock, 2001). However the conclusions of studies that have explored relationships between dyslexia and learning styles have lacked consistency. For example, in a cohort of 117 university students with dyslexia, no link was established between any preference for visuo-spatial learning styles and dyslexia (Mortimore, 2003); this may seem unexpected in the light of later research demonstrating a preference in dyslexic students for knowledge to be presented visually (Mortimore, 2008), and other research suggesting that one of the characterising aspects of dyslexia can be elevated visuo-spatial abilities in certain circumstances (Attree et al., 2009; Brunswick et al., 2010). Indeed, professional practice in university level support for dyslexic students regularly advocates, and subsequently provides assistive learning technologies such as concept-mapping tools that are designed to make learning more accessible for those with visual learning strengths (Draffan et al., 2014). This continues to be a central provision of technology support for dyslexic students in receipt of the (UK) Disabled Students' Allowance, despite evidence suggesting that some alternative means to provide easier access to learning for dyslexic students appears to have equal learning value to both dyslexic and non-dyslexic students (Taylor et al., 2009). Indeed, whether it is desirable to integrate student learning style preferences, however these may be categorized or defined, into pedagogic design has attracted mixed support, although the more recent move towards a mass HE system appears to have generated a renewed interest in learning styles, not least as means to accommodate the much wider diversity of student communities at university (Smith, 2002).

The later advent of social media as a learning device, or at least as a learning enabling device, may have reduced interest in analysing learning styles per se. This is because the more personal nature of accessing learning resources that is permitted in, for example, multimodal, mobile cloud computing technologies has enabled students with dyslexia to engage with their learning resources in ways to suit their individual learning preferences (Alghabban et al., 2017). This may be especially the case where such learning resources have been accessed through social media portals, possibly lessening responses to improving learning access at institutional levels. Hence, adapting teaching to suit learners is being achieved without recourse to finding out in detail how learners prefer to learn. This approach to presenting more personalized learning experiences is enshrined through the advent of Smart Learning Environments (SLEs), echoing the ethos of UDL. An SLE has been defined as a learning place which features widespread incorporation of innovative technologies to permit greater flexibility, adaptation, engagement and feedback for learners (Spector, 2014); these are learning environments which, by turning around the idea of curriculum delivery into curriculum uptake, foster student engagement at a highly personalized level. For those with learning differences in whatever form, this approach is likely to ameliorate many of their current challenges (Lenz et al., 2016), and hence make learning fairer and more equitable so that 'difference', 'disorder', 'difficulty', and 'deficit' will have much reduced relevance in a such a learning environment.

### IV Labels, categories, dilemmas of difference, inclusivity

The issue of difference has a long history both in education and in society more generally. Amongst communities of learning, educationalists and practitioners have agonized about how best to deal with learners who are 'different' without stigmatizing them on the basis of their difference. It should be taken as a ‘given’, that education and learning should inhabit a space in which prejudice is absent, in which everyone is treated fairly and non-judgmentally, where discrimination is not tolerated, especially where equality of opportunity underpins educational provision. Nevertheless, identifying a trait of difference - where this is established by a dominant, majority group - will risk emboldening a conceptual separation based on that trait; conversely, non-identification of minority groups or a non-acknowledgement of difference equally risks discrimination through the application of majority norms and perspectives without regard for the possible alternative needs of a minority (Minow, 1985). Such is the dilemma of difference which has driven the inclusion/exclusion debate in education since it was recognized that not all learners learn in the same ways, and hence that traditional, conventional teaching and curriculum delivery may not be suited to all learners. However, inclusion is variously conceptualised in educational contexts (Messiou, 2017) ranging from being primarily concerned with disability and special education needs, to defining inclusion as an objectively standardizing approach to education and society through the adoption of values such as equity and respect for diversity (Ainscow et al., 2006). Messiou focuses on Ainscow’s principled approach to defining inclusion adding that in practice, this means more than talking about the facilitation of active involvement and participation in learning contexts because it should embrace the wider concepts of presence and achievement as well as 'where' and 'how' children are educated. In other words, focusing on all students rather than on differentiated groups (op cit), which implies that to do otherwise may lead to marginalization and feelings of 'otherness' (French & Herrington, 2008; Mortimore, 2013).

In the face of this being quite a convincing social justice perspective on inclusivity in education, by taking a reactionary and critical standpoint, it might be argued that there is an alternative, well-rehearsed polemic that has sought to justify the categorization of learners as a convenient exercise in expediency. That is, as essential for establishing rights to differentiated 'support', this being considered the most efficacious form of intervention as a mechanism which outwardly at least, is designed to meet the different learning needs of minority groups (Elliott & Gibbs, 2008). This is support which aims metaphorically to shoe-horn a learner labelled with 'special needs' into a conventional learning box. In HE contexts, this may be through the application of 'reasonable adjustments' to curriculum access as a remediative process to compensate for learning challenges purportedly attributed to these individuals' apparent learning disabilities. Outwardly, this is neat, usually well-meaning, ticks boxes, appears to match learner-need to institutional provision, and ostensibly levels the academic playing field so that such learners can 'perform' in a fair and comparable way with their peers. An analysis of datasets provided by the Higher Education Statistics Agency (HESA) showed that this appears to work for most categories of disabled learners in HE, also demonstrating that where some groups did appear to be under-performing, this was due to confounding factors unrelated to their disabilities (Richardson, 2009). However, even setting aside the undesirability of such solutions in the context of a properly inclusive practice, it is possible that such accommodations may positively discriminate against learners who present 'differences' leading to unfair academic advantage because the 'reasonable adjustments' that have been made were somewhat arbitrarily determined and lack scientific justification (Williams & Ceci, 1999). Indeed it has been reported that some students, witnessing their friends and peers in possession of newly-provided laptops, study-skills support tutorials and extra time to complete their exams, all of which has been provided through support funding, go to some lengths to feign difficulties in order to gain what they perceive to be an equivalent-to-their-friends, but better-than-equal academic advantage over others not deemed smart enough to play the system (Harrison et al., 2008; Lindstrom et al., 2011).

For dyslexia, there is some argument to suggest that, contrary to being associated with persistent failure (Tanner, 2009), attaching the label of dyslexia (however defined) to a learner can be an enabling and empowering process at university, exactly because it opens access to support and additional aids, especially assistive technology which can have a significantly positive impact on study (Draffan et al., 2007). It has been demonstrated that the psychosocial impacts of being designated as dyslexic have led some individuals to embrace their dyslexia and to identify and use many personal strengths in striving for success, in whatever field (Nalavany et al., 2011). Outwardly this seems to be strongly aligned with the neurodiversity approach; however Grant (2009) points out that neurocognitive profiles are complicated and that the identification of a specific learning difference might inadvertently be obfuscated by a diagnostic label, citing dyslexia and dyspraxia as being very different, but which share many, perhaps confusing similarities at the neurocognitive level. Ho (2004) argued that despite the 'learning disability' label being a prerequisite for access to differentiated provision in learning environments and indeed, civil rights protections, these directives and legislations have typically provided a highly expedient route for the tacit adoption of the medical model of learning disabilities by official channels and processes. This is where disability is considered as the disabled individual's fault - and hence enables institutions to pay less attention or even ignore completely their challenges in educational systems. One conclusion that may be drawn here is that wherever schools and universities persist in relying heavily on reading to impart and subsequently to gain knowledge, and require writing to be the principal medium through which learners can express their ideas and be assessed, explaining the poor performance of some groups by pathologizing them may enable institutions to avoid examining their own failures (Chanock, 2007). Although this might be viewed as a stinging appraisal of well-intentioned attempts to accommodate differences, it cuts to the quick of how the agendas of inclusivity ought to be both designed and properly implemented in learning institutions to ensure that equitable learning opportunities are provided for all.

Further arguments focus on stigmatization associated with 'difference': On the disability agenda, the relationship between disability and stigma is examined, with several studies drawing on social identity theory. Originally theorized by Tajfel and Turner (1979), it was suggested that part of an individual's concept of who they are, their self-identity, comes from their sense of belonging to a particular group, hence their social identity. Moreover, that as part of their group, individuals align themselves with group identity, norms, attitudes, and behaviours (Tajfel, 1982). In a later study about disability identification, Nario-Redmond et al. (2012) supported the view that individuals may cope with stigma by applying strategies that seek to minimize stigmatized attributes, often accompanied by active membership of stigmatized groups in order to enjoy the benefit of collective strategies as a means of self-protection. An earlier study had identified the self-protective dimension of group attachments, especially where the group is representative of individuals marginalized by the wider society as a result of their difference, whether this be through disability or any other minority characteristic judged to be worthy of exclusion by the conformist majority (Crocker & Major, 1989). Social stigma itself can be disabling and the social stigma attached to disability is particularly so, not least due to a historical attribution of disability to the individual themselves - that is, adopting the medical model of disability which considers a disabling condition pathologically (Burch & Sutherland, 2006). However, there is a significant body of research that identifies disadvantages in all walks of life that result from the stigmatization of disabilities (e.g.: McLaughlin, et al., 2004; Morris & Turnbill, 2007; Trammel, 2009). Even in educational contexts and when the term is arguably softened to 'difficulties' or even more so to 'differences', the picture remains far from clear with one study (Riddick, 2000) suggesting that stigmatization may already exist in advance of labelling, or even in the absence of labelling at all, or that there is not necessarily a connection between labels of so-called impairment and the categorization of those who require additional or different provision (Norwich, 1999). Sometimes a stigma is more associated with the additional, and sometimes highly visible, learning support designed to ameliorate some learning challenges (Mortimore, 2013) - students accompanied by note-takers for example - with some studies reporting a measurable social bias against individuals with learning disabilities who were perceived less favourably than their non-disabled peers (e.g.: Tanner, 2009; Valas, 1999). Similar evidence relating to this kind of social bias was recorded in a study exploring the disclosure of dyslexia in cohorts of students who successfully entered university to train as nurses, which highlighted the unease of these student-nurses about their local learning communities becoming aware of their dyslexia (Morris & Turnbill, 2007). It is possible, however, this may have been confounded by nurses' awareness of workplace regulations relating to fitness to practice, and how their dyslexia may very significantly reduce their likelihood of gaining employment. It has also been recorded that the dyslexia (learning disability) label might even produce a differential perception of future life success and other attributes such as attractiveness or emotional stability despite such a label presenting no indication whatsoever about any of these attributes or characteristics (Lisle & Wade, 2013). Perhaps of greater concern, is evidence that parents and teachers may have lower academic expectations of young people attributed with learning disabilities or dyslexia based on a perceived predictive notion attached to the label (Shifrer, 2013; Hornstra et al., 2014) and that in some cases, institutional processes have been reported to contribute significantly to students labelled as 'learning-disabled', choosing study options broadly perceived to be less academic (Shifrer et al., 2013).

Stanovich has written extensively on dyslexia, on inclusivity and the impact of the labelling of differences (e.g.: Stanovich, 1988; 1996; 1999; 2005). His position firstly is to promote debate about whether dyslexia per se exists, a viewpoint that has emerged from the research and scientific difficulties that he claims arise from attempts to differentiate dyslexia from other poor literacy skills; and secondly, given that dyslexia in some definition or another is quantifiable, argues that as long as the learning disability agenda remains attached to aptitude-achievement discrepancy measurement and fails to be more self-critical about its own claims, (Stanovich, 1999), its home in the field of research will advance only slowly. Indeed, a short time later he described the learning disabilities field as “not ... on a scientific footing and continu[ing] to operate on the borders of pseudoscience” (Stanovich, 2005, p103). This position clearly advocates a more inclusive definition of learning disabilities to one which effectively discards the term entirely because it is “redundant and semantically confusing” (op cit, p350) a persistent argument that others echo. Lauchlan and Boyle (2007) broadly question the use of labels in special education, concluding that aside from being necessary in order to gain access for support and funding related to disability legislation, the negative effects on the individual can be considerable and may include stigmatization, bullying, reduced opportunities in life and perhaps more significantly, lowered expectations about what a 'labelled' individual can achieve (ibid). Norwich (1999, 2008, 2010) has written extensively about the connotations of labelling, persistently arguing for a cleaner understanding of differences in educational contexts because labels are all too frequently stigmatizing and themselves disabling, referring to the 'dilemma of difference' in relation to arguments 'for' and 'against' curriculum commonality/differentiation for best meeting the educational needs of differently-abled learners. Armstrong and Humphrey (2008) suggest a 'resistance-accommodation' model to explain psychological reactions to a 'formal' identification of dyslexia, the 'resistance' side of which is typically characterized by a disinclination to absorb the idea of dyslexia into the self-concept, possibly resulting from more often, negatively vicarious experiences of the stigmatization attached to 'difference', whereas the 'accommodation' side is suggested to take a broadly positive view by making a greater effort to focus and build on the strengths that accompany a dyslexic profile, rather than dwell on difficulties and challenges. McPhail and Freeman (2005) have an interesting perspective on tackling the challenges of transforming learning environments and pedagogical practices into genuinely more inclusive ones by exploring the 'colonizing discourses' that disenfranchise learners with disabilities or differences through a process of being 'othered', or how difference or disability is a separatist construction that is then the submissive party in societal power and control relationships. Their conclusions broadly urge educationalists to have the “courage to confront educational ideas and practices that limit the rights of many student groups” (ibid, p284). Pollak (2005) reports that one of the prejudicious aspects of describing the capabilities of individuals under assessment is the common use of norm-referenced comparisons. This idea is inherently derived from the long-established process of aligning measurements of learning competencies to dubious evaluations of 'intelligence', standardized as these might be (for example Wechsler Intelligence Scale assessments (Weschler, 1974)) although it is acknowledged that whereas an absolute score achieved in a test might be arbitrary, taking account of where this score falls in the wider distribution of similar results can be more meaningful. However it might argued that such assessments generally fail to accommodate evaluations of competencies and strengths that fall outside the conventional framework of 'normal' learning capabilities - that is, in accordance with literacy-dominant education systems, which is consistent with Stanovich’s position on the limitations of intelligence-based aptitude competency assessments. However, ‘capabilities' in the context of 'special educational needs', is less than ideal as a descriptor (Norwich, 2013). The 'capability approach' has its roots in the field of welfare economics, particularly in relation to the assessment of personal well-being and advantage (Sen, 1999) where the thesis is about individuals' capabilities to function. Norwich (op cit) puts the capability approach into an educational context by highlighting focus on diversity as a framework for human development viewed through the lens of social justice which is an interesting parallel to Cooper's thesis on diversity taken from a neurological perspective as discussed earlier (sub-section 2.1(II)). This all has considerable relevance to disability in general but particularly to disability in education where the emphasis on everyone becoming more functionally able (Hughes, 2010) is clearly aligned with the principles of inclusivity and the equal accommodation of difference, because the focus is inherently positive as opposed to dwelling on deficits, which connects well with the principles of Universal Design for Learning outlined above.

### V Impact of the process of identification

Exploring the immediate emotional and affective impact that the process of evidencing and documenting a learner's study difficulties has on the individual under scrutiny is a pertinent and emerging research field. (Armstrong & Humphrey, 2008). Perhaps as an indication of an increasing awareness of the value of finding out more about how an individual with dyslexia feels about their dyslexia, studies that relate life or learning histories of individuals with dyslexia are becoming more widespread. For example, Dale and Taylor (2001) found that one group of adult dyslexic learners attending a focus group seeking feedback about a short adult learning study-skills awareness course, were citing the non-recognition of their dyslexia in earlier schooling as inherently disabling; Burden and Burdett (2007) asked 50 adolescents to construct mind-picture images of what dyslexia meant to each of them to explore the affective dimension of dyslexia. The outcome was that most described it as an insurmountable barrier - in learning contexts at least; Evans (2013) explored how student nurses constructed their dyslexic identity, finding that being made to feel stupid was linked to dyslexia both in historical learning contexts as well as in their current learning interactions. In these individuals this widely led to their dyslexia not being disclosed in their workplaces; Cameron and Billington (2015a) looked at how a small group of university students with dyslexia constructed their dyslexic identity with significant themes emerging: firstly, how these students had internalized the power of assessment grading as a marker of worth, and how they perceived this to interact with the status of their dyslexic label; secondly, about the tensions between the idea of high levels of literacy being aspirational, and acknowledging their challenges in reading, writing and spelling; and lastly, an uncertainty about whether or not dyslexia was a morally valuable label to be given. In a similar, HE context, Cameron's later (2016) study exploring the day-to-day experiences of students with dyslexia identified several consistent themes. These included challenges in translating thoughts into coherently expressed ideas, especially when presenting these to peers and lecturers where feelings of not being good enough through being not properly understood increased negative feelings of self-worth, and difficulties with not feeling welcome in academic learning spaces due to experiences of being perceived by peers as 'different'. One intriguing study attempted to tease out meaning and understanding through the medium of social media (Thomson et al., 2015) where anonymous 'postings' to an online discussion board hosted by a dyslexia support group resulted in three, distinct categories of learning identities being established: learning-disabled, differently-enabled, and societally-disabled. It was observed from these postings that while some contributors took on a mantle of 'difference' rather than 'disability' hence expressing positivity about their dyslexia-related strengths, most appeared to be indicating more negative feelings about their dyslexia, with some suggesting that their 'disability identity' had been imposed on them (ibid, p1339) not least through societal norms for literacy. It may be through a collective study (in the future) of others' research in this area that conclusions can be drawn relating to the immediate impact on individuals when they learn of their dyslexia. However, in the absence of any such meta-analysis being found so far, even a cursory inspection of many of the learning histories presented in studies to date generally reveals a variety of broadly negative and highly self-conscious feelings when individuals learn of their dyslexia. Although such reports are in the majority. it is acknowledged that there is some evidence of positive experiences associated with learning about one's dyslexia in studies which have identified learners who claimed a sense of relief that the 'problem' has been 'diagnosed' or that an explanation has been attributed to remediate their feelings of stupidity as experienced throughout earlier schooling.. However, most examples suggest that many learners with dyslexia feel emotionally burdened or troubled by their dyslexia, and that they perceive it to be disabling in many ways, particularly so in learning spaces where feelings of differences or anxiety related to their dyslexia being ‘discovered’ may inhibit their engagement with their learning and their confidence in approaching their studies effectively.

### VI To identify or not to identify - Is that the question?

Hence a dilemma arises about whether or not to (somehow) identify dyslexic learning differences. On the one hand, there is a clear and compelling argument that favours progressively changing the system of education and learning so that difference becomes increasingly irrelevant. On the other, the pragmatists argue that taking such an approach is idealistic and unachievable and that efforts should be focused on finding better and more adaptable ways to 'fix' such minority learners so that they are able to comply more effectively with existing learning-and-teaching norms. In the short term at least, the pragmatists' approach is the more likely to persist but in doing so, constructing an identification process for learning differences that attributes positivity onto the learning identity of dyslexic individuals rather than burdens them with negative perceptions of the reality of difference, would seem to be preferable. This is important for many reasons, not the least of which is that an assessment/identification/diagnosis that focuses on deficit or makes the 'subject' feel inadequate or incompetent is likely to be problematic, however skilfully it may be disguised as a more neutral process. Despite some evidence to the contrary, this may be due to the lasting, negative perception that an identification of dyslexia often brings, commonly resulting in higher levels of anxiety, depressive symptoms, feelings of inadequacy and other negative-emotion experiences, which are widely reported (e.g.: Carroll & Iles, 2006, Ackerman et al., 2007, Snowling et al., 2007). This is especially important to consider in the design of self-report questionnaires that may form part of an assessment, where replies are likely to be more reliable if the respondents feel that the responses they provide are not necessarily portraying them poorly, particularly so in the self-reporting of sensitive information that may be adversely affected by social influences and which can impact on response honesty (Rasinski et al., 2004).

Thus it would appear that identifying dyslexia through a binary process is not especially helpful, because dyslexia is most recently being constructed as a multifactorial or multidimensional situation, as outlined above in sub-section 2.1(I) .Recall that this is where dyslexic individuals present a wide range of characteristics and attributes that reflect both skills and talents, as well as difficulties and challenges, all to varying degrees. Hence devising a process for gauging the ‘level of dyslexia’ that an individual may present can have value in an educational context, because it might encourage a better alignment of learning strategies to learning strengths whilst at the same time identifying ideas for reducing the impact of difficulties and weaknesses. This may be especially true in literacy-based learning activities where the dyslexic student, intellectually capable as they are likely to be, may still experience some challenges when engaging with an academic environment. Gauging dyslexia as the ‘severity of dyslexia’ is not consistent with the stance of this current study because one of the underlying strands is to try to approach the dyslexic condition from a positive perspective. To contextualize the level of dyslexia as the *severity* of dyslexia implies the opposite, as the argument thence has tried to present, not least because to do so aligns dyslexia with the deficit/discrepancy model and worse, when dyslexia is diagnosed, alludes to it being a disabling illness which needs treatment, cognate to the now outdated medical model of disability. However, it has already been established (in sub-section 2.1(I)) that in the current climate, labelling a learner with a measurable learning challenge such as dyslexia, which, under the terms and descriptors of the Equality Act 2010, is classified as a disability (in the UK), opens access to learning support services. These are designed to scaffold the ‘reasonable adjustments’ and other accessibility constructs that are offered by higher institutions for compliance with disability legislation, to try to ensure equal learning opportunities for disabled students. This at least is one justification for devising mechanisms for assessing firstly whether an individual is dyslexic or not, but also for determining the *extent* of the dyslexic learning differences so that the required range of learning support provisions might be established to enable this student to function more equally in the predominantly non-dyslexic learning environment of university.

### VII Measuring dyslexia - "*How 'dyslexic' am I?*"

Thus it might be thought that 'measuring dyslexia' is a natural consequence of 'identifying dyslexia' and although commonly used dyslexia screening tools such as the Lucid Adult Dyslexia Screener (LADS) (Singleton & Thomas, 2002) or the Dyslexia Adult Screening Test (DAST) (Fawcett & Nicholson, 1998) offer comprehensive outputs from a range of tests and assessments, these all require interpretation. In UK universities this is usually the task of a Disability Needs Assessor and because the outputs from the tests and assessments tend to be quite ‘technical’, this professional interpretation forms an important part of guiding a dyslexic student towards more clearly understanding their dyslexia and how it may impact on their studies at university. An indication of dyslexia that results from a screening is generally accompanied by a recommendation for a 'full assessment' which, in the UK at least, is conducted by an appropriately qualified and registerd psychologist or specialist teacher/assessor. However, it might be argued that even such a comprehensive and possibly daunting 'examination' does not produce much of a useful *combined* measurement to describe the *extent* of the dyslexic difference identified, because the collective outputs from the batteries of assessments are generally interpreted into broad descriptors of 'mild', 'moderate' or 'severe' to indicate how dyslexic an individual is. Although these assessment tools do provide scores obtained on the tests that are commonly administered, these are generally of use only to specialist practitioners and not usually presented in a format that is very accessible to the student being assessed. For example, in this researcher's own experience of working with students with dyslexia at university, one student recounted that on receiving the assessment indication of his dyslexic learning difference he asked *how dyslexic* he was, to be told that is was mild to moderate, leaving him none-the-wiser (respondent #9, Dykes, 2008, p95).

In addition to facilitating a route towards focused but differentiated study skills support interventions, this identifying or assessment process is an essential component for any claim to the Disabled Students' Allowance (DSA), although ironically, the assessment has to be financed by the student and is not recoverable as part of any subsequent award. This in itself may be a barrier to formal assessment, a conjecture possibly supported because it is acknowledged that university communities are likely to include a significant proportion of unidentified dyslexic students (Tops et al., 2012; Lindgren, 2012; Belger & Chelin, 2013), Thus, for those who have become aware that dyslexia might account for their academic difficulties, or may even have been told as much by tutors or perhaps their peers, the costs of an assessment to confirm dyslexia or not could deter them from undertaking one. Certainly for school-aged learners, identifying dyslexia is rooted in establishing capabilities that place them outside the 'norm' in assessments of competencies in phonological decoding and automaticity in word recognition, and in other significantly reading-based evaluations as has been broadly outlined earlier (sub-section 2.1(II)). Sometimes these include assessments of working memory such as the digit span test, which has relevance to dyslexia because working memory abilities have clear relationships with comprehension. If a reader arrives at the end of a long or complex sentence but fails to remember the words at the beginning long enough to connect with the words at the end, this is likely to compromise understanding. All of these identifiers carry useful, quantifiable measures of assessment, although they are discretely determined, and not coalesced into an overall score or value. Nevertheless, at early-learning levels these processes have proved to be sufficient for educators to establish dyslexia in children. However, evidence suggests that identifiers used for catching the dyslexic learner at school do not scale up very effectively for use with adults (e.g.: Singleton et al., 2009). This may be especially true for the academically able learners that one might expect to encounter at university who can, either actively or not, mask their difficulties (Casale, 2015) or even feign them if they perceive advantage to be gained (Harrison et al., 2008). But recent studies continue to reinforce the idea that dyslexia is a set of quantifiable cognitive characteristics (Cameron, 2016) which extend beyond the common idea that dyslexia is mostly about poor reading, writing and spelling, certainly in the university environment. It is acknowledged that difficulties associated with compromised literacy skills can be common in university students because dyslexia in one form or another persists into adulthood (Hanley, 1997; Elbro et al., 1994; Kirby et al., 2008). Evidence for this is especially apparent in studies that focus on the impact of phonological awareness on reading ability (Shaywitz et al., 1999; Svensson et al., 2003). It is also evident that identifying dyslexia in adults is more complicated than in children, especially in broadly well-educated adults attending university because many of the early difficulties associated with dyslexia may have receded as part of their progression into adulthood (Kemp et al., 2009; Undheim, 2009). This may have been either as a result of early support, or through self-developed strategies to overcome early-learning difficulties. Such individuals have come to be regarded as 'as compensated adult dyslexics' in some studies (e.g.: Lefly & Pennington, 1991; Brunswick et al., 1999; Miller-Shaul, 2005; Beidas et al., 2013;), at least in regard to their phonological processing skills, and hence reading, writing and spelling abilities. The research is far from conclusive about the reasons for dyslexia compensation, so it is of significant interest to note that very recent research concerning the abilities of dyslexic university students to overcome the persistent phonological deficits which have essentially characterized the identification of their dyslexia, suggests that this may be achieved through their development of morphological knowledge in reading (Cavalli et al., 2017). In linguistics, morphology concerns the structure of words in terms of morphemes as the smallest indivisible elements of words which take or indicate meaning; for example, in 'unhappy' the 'un' indicates 'not', or in 'teacher' the 'er' indicates one who teaches. Hence morphemes are more related to meaning, whereas phonemes are related to auditory correspondences in work construction. Many languages but particularly English, tend to be comprised of morphemes as well as phonemes and this may explain why although phonological awareness may be a good indicator of reading skills, it is not infallible because sensitivity to each of these word units might be significant in decoding abilities (Singson et al., 2000). The Cavalli et al. study revealed that in the higher-functioning adults that comprised their sample of university students (n=40) there was a significant disassociation between the development of morphological abilities and phonological ones, and that the magnitude of this disassociation correlated with reading ability (ibid). This result was in keeping with an earlier study (Martin et al., 2014) which also suggested that this development of strong morphological awareness could be a significant compensation in the development of literacy skills for dyslexic students, with both of these studies building on a body of research that is exploring which aspects of the reading ability required in university students have been compensated in those with dyslexia, and how this compensation has been executed (e.g.: Parrila & Georgiou, 2008).

What emerges from this overview, is evidence that at university, other dimensions of dyslexia aside from reading ability and phonological processing, may be more significant characteristics of many dyslexic university students' learning needs. This may be because these adults can have developed strong strategies for dealing with earlier reading weaknesses. Hence, identification and assessment processes that have literacy and decoding skills at their core, are, not so much less relevant than such tests may have been for earlier-years learners, but that other, dyslexia-inherent issues are likely to be more significant in university learning contexts.

#### Adult dyslexia assessments

The last two decades or so have seen the development of a number of assessments and screening tests that aim to identify – but not specifically measure - dyslexia in adults. This has emerged particularly in HE contexts as a response to the increasing number of students with dyslexia attending university (HESA, 2018; Dobson, 2018). An early example of a screening assessment for adults is the Dyslexia Adult Screening Test (DAST) (Nicholson & Fawcett, 1997). This is a modified version of an earlier screening tool used with school-aged learners, but which followed similar assessment principles, mostly based on literacy criteria, although the DAST does include a backward digit span test, a non-verbal reasoning test, and a posture stability test. One limitation of the DAST to accurately identify students with dyslexia was evidenced by an appraisal suggesting inadequate validation and standardization (Harrison & Nichols, 2005) although other studies to corroborate this have not been found. Computerized screening tools have been available for some time, such as the Lucid Adult Dyslexia Screening (LADS) (Lucid Innovations, 2015), which generates a graphical report indicating that the individual is either 'at risk' or 'not at risk'. Aside from being a coarse discriminator, 'at risk' might be taken as implying that dyslexia is viewed through the lens of negative and disabling attributes. It is unclear what an identified individual is 'at risk' of, possibly suggesting that further or worsening dyslexic characteristics may develop if the condition remains unidentified or perhaps even ‘treated’? The screening test comprises five sub-tests which measure nonverbal reasoning, verbal reasoning, word recognition, word construction and working memory (through the backward digit span test), and indicates that just the final three of these sub-tests are dyslexia-sensitive. The reasoning tests are included based on claims that to do so improves screening accuracy, and that results provide additional information 'that would be helpful in interpreting results' (ibid, p13). This appears to be attempting to provide a measure of the individual's 'intelligence' - which, in the light of Stanovich's standpoint on intelligence and dyslexia mentioned previously (see sub-section 2.1(I)), is of dubious worth, and might be an indication that the authors of the screening test believe that there is an associative relationship between intelligence and dyslexia; an idea which has been repeatedly debunked. For example, Gus and Samuelsson (1999) argued that there is no clear, causal relationship between intelligence level and decoding skills not least because intelligence is a 'fuzzy concept' which can be assessed in a wide variety of ways, and one of the findings of the Rose review (2009) was that dyslexia is unrelated to intellectual abilities.

However there have been other attempts to create electronic, computerized screeners, particularly since desktop computer facilities have become more widely available. Worthy of mention is the QuickScan + StudyScan Suite (Pico Educational Systems, 2011) which was was developed from data collected from 2000 university students attending two HE institutions in the UK of whom 200 were known to be dyslexic (Zdzienski, 1998). This is included in the discussion here because the design rationale shares similarities with the approach adopted in this current project for the Dx Profiler whereby the aim of the screener was to produce a wide profile of skills, attributes and characteristics through a blend of assessments that took study processes, perceived strengths and weaknesses and learning style preferences as the principal foci of its self-report questionnaire. These included a range of other characteristics and attributes that are indicators of a dyslexia with these being drawn from Vinegrad's Adult Dyslexia Checklist (1994) which has also been informative in the development of the Dx Profiler in this project. As such, the QuickScan screener sets an early precedent for an evaluator that attempts to gauge dyslexia-ness as a potentially impacting element within a wider academic learning management profile, many of the aspects of which might be equally applicable to students with no indications of a conventionally-defined dyslexia, much as the data analysis outcomes of this thesis have also revealed. The process required the screening tool, QuickScan, to be used first where 112 self-report questions were asked; these ranged from statements gauging working memory, competencies in systematic memory recall, time-management and organization, perceived competencies in reading and spelling, handedness, together with questions which were dubiously aligned with the vision-differences theories of dyslexia such as 'do you find that your eyes tend to get tired when reading?' and other outwardly incongruous questions such as 'do you tend to hum or talk to yourself?', 'if you get angry do you often shout?' and 'when visiting somewhere for the first time, is it the atmosphere and the feel of the place that makes the greatest impression on you?'. Respondents were required to provide only a binary (yes or no) response. No Likert-style anchor point gradations were provided to enable other response selections such as 'sometimes' or 'infrequently' to be offered. The screener remains available as a desktop application and so it was reviewed. Questions are presented in a small, on-screen text box where colour combinations between text and background are selectable from a modest choice, as is font size, echoing the popularity at the time for providing accessibility tools to make the reading of on-screen text less visually stressful, although the relationship between dyslexia and visual stress had remained contentious (Singleton & Trotter, 2005). No provision is made for audio presentation of questions, for example by using a text-to-speech engine although this may be because text-to-speech applications such as TextHelp Read & Write (Texthelp Ltd, 2015) and ClaroRead (Claro Software Ltd, 2017) were at an early stage of development and not readily available at the time. It is claimed that 15 minutes is sufficient to complete the test but on working through the screener twice with an interval of at least 6 months between the two attempts, both took me longer than 20 minutes. The questions were answered quickly without hesitations for 'thinking time'; I have no known dyslexic learning differences and would imagine that my academic experience may have fostered a better-than-average text-scanning capability together with a familiarity with the content and context of the questions in the assessment. So, it is doubtful that a student with little or no experience of such assessments would complete it in the suggested 15 minutes. The output provided at the end of the test is a cursory, summary evaluation of learning styles (mine came out as 'multisensory' both times) with some broad guidance and advice about how to make best use of that information. Also presented were indications about whether or not a need for supplementary study support had been indicated and whether specific learning difficulties consistent with dyslexia were revealed - it suggested neither for me. If the QuickScan screener reports otherwise, the intended pathway is for the StudyScan diagnostic tool to be applied. This was a much more comprehensive diagnostic process based on the American Scholastic Abilities Test for Adults (SATA - Bryant et al., 1991) comprising 17 distinct assessments including non-verbal and verbal-reasoning tests for memory, phonological competencies, visual processing, reading and writing speeds, punctuation, numerical calculations. It was expected that the complete assessment would take between two and four hours which, by any reasonable judgment, would have made it a demanding and onerous task, especially so for the very students it was attempting to identify.

An extensive critique of the QuickScan + StudyScan Suite was conducted in a three-university collaborative project (Haslam & Kiziewicz, 2001) with data collected principally from students who undertook the complete assessment process (n=126). These data were collected at just one of those universities which had a well-developed Learning Support Service and access to data from a greater number of students with dyslexia. Haslam and Kiziewicz made a number of astute conclusions about the viability of the Suite, noting logistical challenges in administering a two-stage computerized test not least due to technical issues with the hardware and software used to present them but also due to the amount of time required to complete the tests, reporting that 'some students returned several times to complete the assessment' (ibid, p15). This highlighted the further difficulty of respondent attrition where many students who screened as likely to be strongly dyslexic in the first-stage screener failed to complete, or even to attend the second stage multi-test StudyScan profiler. One interesting feature emerged out of the classification table of correlations between the outcomes of the QuickScan screener and those of the StudyScan assessment in that exactly half of the students who were shown by the QuickScan screener as presenting 'some of the indicators' of dyslexia and who went on to take the full StudyScan assessment were subsequently shown to have profiles which were either 'not consistent with dyslexia' or 'borderline' or presented an 'inconclusive indicator'. A similar outcome has been observed in the current study which will report in Section 4 that a not insubstantial proportion of students who either declared no learning challenges or who declared their dyslexia presented a Dx value that also put them in an apparently 'borderline' area. There may be many explanations for this, especially as both the survey conducted by Haslam and Kiziewicz and this current project derived data from relatively small sample sizes (n=126 and n=166 respectively) which is a limitation on the generalizability of the outcomes. However, as both studies appear to have revealed a sizeable number of students who might be regarded as partly dyslexic, or just dyslexic sometimes or in particular circumstances, the idea cannot be ignored that this may be evidence of the significant difficulties that remain when designing new processes for determining whether a student presenting a particular set of study or academic learning management difficulties is actually presenting dyslexia or not. This is the point made by Elliott and Grigorenko (2014) who conclude that if a workable assessment tool is to be devised and developed, then the primary issue is establishing sensible boundary conditions above and below which dyslexia is considered to be the cause of the student's difficulties or not. This is, of course, not least due to a) the persistent difficulty in defining dyslexia in the first place and b) the wide diversity of learning differences that may be presented. Further doubts about the viability of the QuickScan + StudyScan Suite were identified by Sanderson (2000) whose highly critical report on unspecified 'pilot studies' of the Suite identified serious flaws in both the assessment's validity and lack of evidence of reliability. Ensuring that a test for dyslexia is valid raises a multitude of issues, not least due to the wide variety of attributes and characteristics present or absent in a bewildering array of combinations but widely regarded as possible indicators of dyslexia. Sanderson also highlighted concerns over the Suite's use of the concepts of preferred learning styles as one of the data-outcome quantifiers. Principally the criticism was that adopting the idea that preferred learning styles are fixed is dubious, citing evidence from other researchers (ibid, p286: Miles, 1991; Thomson, 1999) to highlight not only the complexity and possible fluidity of an individual's learning style but also how this may be influenced by pedagogical experiences. Mortimore (2005) also indicated the need for a cautious approach to learning styles evaluations based on limited data sources, especially when these are intended to classify learners and determine teaching approaches, not only in respect of working with dyslexic learners but also more widely. Sanderson (op cit) concluded that the publication of the QuickScan + StudyScan Suite was premature and that more work was needed at a fundamental level before the Suite could be used with confidence as a dyslexia identifier.

However, this does not alter the fact that building profiles of learners that, through careful interpretation, might provide insights into ways in which they function in learning domains can be useful provided the outcomes of the profilers are not used too deterministically. Dyslexia is clearly not a black-and-white construct and mounting evidence supports the view that categorizing students, in HE in particular, as dyslexic or not is unhelpful, possibly stigmatizing; this is especially so when dyslexia is diagnosed as a disability. Furthermore, it becomes positively discriminatory when legislation that seeks to redress apparent disadvantage might in fact, bestow academic advantage (as mentioned previously), not least through the application of 'reasonable adjustments' which are either ‘better than reasonable’ or which may threaten academic standards by adjusting assessment criteria to compensate for learning challenges (Riddell & Weedon, 2007); this is especially the case where these might be said to be due to institutional curriculum delivery arrangements rather than being attributable to the individual learner. But gaining knowledge of a dyslexia, however it may be defined, is liberating and empowering for some adult learners (as mentioned earlier in sub-section 2.1(V)) because this might at last enable them to understand why they may have found learning so challenging in the past. Navigating a path through this landscape has been one of the greatest challenges of this research project and hence, has contributed to the rationale for designing and building the specific, evaluative tool to meet the needs of this study's research questions. By adopting an approach to devising a metric that considers variances in study behaviours and learning preferences as the basis of its working parameters, the Dx Profiler is building on the emerging discourse that is grounded in non-cognitive evaluative processes. An overview account of this design and development is presented in Section 3.1(III).

Warmington et al. (2013) responded to the perception that dyslexic students present additional learning needs in university settings in comparison with earlier-years learners, also stating that as a result of the increased participation in HE in the UK more generally, there is likely to be at least a corresponding increasing in the proportion of students who present disabilities or learning differences. Warmington quotes HESA (Higher Education Statistics Agency) figures for 2006 as 3.2% of students entering HE with dyslexia, while a recent enquiry to HESA elicited data for 2013/14 which indicated students with a learning disability accounting for 4.8% of the student population overall (Greep, 2017). However, this category also accounts for 48% of students disclosing other disabilities such as visual impairments or unseen mental health conditions. Hence, HESA does not identify dyslexia specifically, although Greep stated that HESA is of the opinion that dyslexia is by far the most numerous amongst the learning disabilities accumulated into this category. This makes students with dyslexia the biggest single group of students with disabilities at university (ibid). It is also of note that the HESA data are likely to under-report the number of students with a specific learning difficulty (that is, dyslexia) because where this occurs together with other impairments or medical/disabling conditions, specific learning difficulty is not reported as a discrete category with no way of identifying the multiple impairments (ibid). At any rate, both of these data are consistent with the conclusions that the number of students with dyslexia entering university is on the rise. Given the earlier reference to dyslexia being first-time identified in a significant number of students, post-entry, it is reasonable to suppose that the actual proportion of dyslexic students at university is substantial and also include many who are unidentified. Indeed, this current study is relying on finding such *quasi*-dyslexic students in the university community.

The York Adult Assessment-Revised (YAA-R) was the focus of the Warmington et al. study which reported data from a total of 126 students, of which 20 were known to be dyslexic. The YAA-R comprises tests of reading, writing, spelling, punctuation and phonological skills that are pitched most directly to assess the literacy-related abilities and competencies of students at university (ibid). The study concluded that the YAA-R has good discriminatory power of 80% sensitivity and 97% specificity. However, given that the focus of the tests is almost entirely on literacy-based activities, it fails to accommodate assessments of the wide range of other strengths and weaknesses often associated with a dyslexic learning profile that are outside the envelope of reading, writing and comprehension. A similar criticism might be levelled at the DAST as this largely focuses on measuring literacy-based deficits. Indeed, Chanock et al. (2010) trialled a variation of the YAA-R (adjusted in Australia to account for geographical bias in the UK version) as part of a search for a more suitable assessment tool for dyslexia than those currently available. Conclusions from the trial with 23 dyslexic students and 50 controls were reported as 'disappointing' due not “to the YAA-R's ability to differentiate between the two groups, but with the capacity to identify any individual person as dyslexic” (ibid, p42), as it failed to identify more than two-thirds of previously assessed dyslexic students. Chanock further narrates that self-reporting methods proved to be a more accurate identifier - Vinegrad's (1994) Adult Dyslexia Checklist was the instrument used for the comparison. A further criticism levelled at the YAA-R was that it was developed on the basis of data collected from students at only one HE institution, suggesting that differences between students in different institutions was an unknown and uncontrollable variable not accounted for, but which might influence the reliability and robustness of the metric.

Tamboer and Voorst (2015) developed an extensive self-report questionnaire-based assessment to screen for dyslexia in students attending Dutch universities. Divided into three sections: biographical questions, general language statements, and specific language statements, which although still retaining a strong literacy-based focus, this assessment tool does include items additional to measures of reading, writing and copying, such as speaking, dictation and listening. In the 'general language statements' section, some statements also referred to broader cognitive and study-related skills such as 'I can easily remember faces' or 'I find it difficult to write in an organised manner'. This seems to be a good attempt at developing processes to gauge a wider range of attributes that are likely to impact on learning and study capabilities in the search for an effective identifier for dyslexia in university students, and is consistent with the Tamboer et al. construction of dyslexia as a multifactorial condition. This model also resonates with an earlier self-report screening assessment which, in its design, acknowledged that university students with dyslexia face challenges that are in addition to those associated with weaker literacy skills (Mortimore & Crozier, 2006). In contrast to Chanock's findings concerning the YAA-R reported above, Tamboer and Voorst's assessment battery correctly identified the 27 known dyslexic students in their research group - that is, students who had documentary evidence as such - although it is unclear how the remaining 40 students in the group of 67 who claimed to be dyslexic were identified at the pre-test stage. Despite this apparent reporting anomaly, this level of accuracy in identification is consistent with their wider review of literature, concluding that there is good evidence to support the accuracy of self-report identifiers (ibid).

The majority of current devices used in HE settings for identifying dyslexia search diagnostically for deficits in specific, cognitive capabilities and use baseline norms as comparators. These are predominantly grounded in lexical competencies. As long as the literacy-based hegemony prevails as the defining discourse in judgments of academic abilities (Collinson & Penketh, 2010) there remains only a perfunctory interest in devising alternative forms of appraisal that might take a more wide-ranging approach to gauging academic competencies, and especially how these may be impacted by learning differences. All of the tools use a range of assessments which are built on the assumption that dyslexia is principally a phonological processing deficit that is accompanied by other impairments in cognitive functioning which collectively, are said to disable learning processes to a sufficient extent that the 'diagnosed' individual is left at a substantial disadvantage in relation to their intellectually-comparable peers. This project is interested in measuring levels of dyslexia-ness rather than identifying dyslexia as it is central to the methodological processes of this project that a metric is devised that focuses on study attributes and learning preferences rather than the cognitive characteristics conventionally regarded as deficit indicators in individuals with dyslexia. This is also consistent with the approach focus for the ABC Scale as this was devised to gauge academic confidence in terms of study actions, plans and behaviours that impact on academic study. It is not concerned with cognitive factors. It is of note that there is a small but growing recognition in university learning development services and study skills centres, noted anecdotally, that finding alternative mechanisms for identifying study needs, whether these appear to be dyslexia-related or not, is desirable, especially in the climate of widening participation currently being promoted in our universities. Although these have been driven through a need for finding improved and positively-oriented mechanisms for identifying learning differences typically observable in dyslexic students (Casale, 2015; Chanock et al., 2010; Singleton & Horne, 2009; Haslum & Kiziewicz, 2001) what appears to be emerging is that many characteristics that are being evaluated may prove more broadly useful as identification discriminators in the realm of study skills and academic learning management across complete university communities of learners. In other words, finding ways to describe dyslexia multidimensionally as opposed to discretely identifying or diagnosing it is gaining traction, and there is evidence that this is being achieved through the use of non-cognitive parameters, notably supported by evidence provided through discursive constructions of dyslexia using the everyday lived experiences of dyslexic students at university (Tanner, 2009; Cameron & Billington, 2015a; Cameron & Billington, 2015b; Cameron, 2016; MacCullagh et al., 2016) and amongst adults with dyslexia more widely (Nalavany et al., 2011; Thompson et al., 2015).

Thus, in none of the more recently developed screening tools is there mention of a criterion that establishes *how* dyslexic a dyslexic student is, other than either in coarsely-defined gradations such as 'mild', 'moderate', 'severe', or otherwise by presenting the raw score outcomes for each of a wide range of tests and assessments which are not cohesively bound into an easily-comprehensible value. Elliott and Grigorenko (2014) argue that a key problem in the development of screening tools for dyslexia is in setting a separation boundary between non-dyslexic and dyslexic individuals that is reliable, and which cuts across the range of characteristics or attributes that are common in all learners in addition to literacy-based ones, and especially for adults learners. It is widely reported that students at university, by virtue of being sufficiently academically able to progress their studies into HE, have frequently moved beyond many of the early literacy difficulties that may have been associated with their dyslexic learning differences to perform competently in many aspects of university learning (Henderson, 2015). However, the nature of study at university requires students to develop their generic skills in independent self-regulated learning and individual study capabilities, and enhance and adapt their abilities to engage with, and deal resourcefully with learning challenges generally not encountered in their learning histories (Tariq & Cochrane, 2003). Difficulties with many of these learning characteristics or 'dimensions' that may be broadly irrelevant and go un-noticed in children may only surface when these learners make the transition into the university learning environment because learning in HE requires greater reliance on self-regulated learning behaviours in comparison to earlier, compulsory education contexts where learning is largely teacher-directed. It will be shown below (sub-section 2.2(IV) that one factor which influences the effective development of self-regulated of learning is academic confidence. Many students, whether they are dyslexic or not, struggle to deal with these new and challenging learning regimes at university (see for example: Leathwood & O'Connell, 2003; Reay et al., 2010), not least as an outcome of successful, widening participation initiatives in UK HE which have also brought substantial increases in attrition rates amongst the very students from 'non-traditional' backgrounds that have been successfully recruited (Crozier et al., 2008). This has seen many, if not most universities develop generic study-skills and/or learning development facilities and resources to support all students in the transition from regulated to self-regulated learning with evidence for this being widespread, ranging from reports on the successes of more general social capital interventions (Schwartz et al., 2018) to initiatives that are more keenly focused, for example on targeted discipline specific areas such as enhancing maths and numeracy skills amongst engineering students (Choudhary & Malthaus, 2017). It is possible that increasing institutional awareness of duties to respond to quality assurance protocols and recently introduced measures of student satisfaction such as the TEF (Teaching Excellence Framework) has also influenced the development of academic skills provisions in universities, together with a commercial interest in keeping levels of attrition to a minimum to reduce the financial consequences of loss of student-fees and to minimize the publicity impact that attrition levels might have on future student recruitment. But for many students, gaining an understanding of why they may be finding university increasingly difficult, perhaps more so than their friends and peers, does not happen until their second or third year when they subsequently learn of their dyslexia, most usually through referral from diligent academic staff to learning support services (e.g.: Doherty, 2015). It might be argued that these students have been the 'fortunate few' leaving others with no formally identifiable learning, or academic learning management challenges potentially unsupported. One earlier research paper established that more than 40% of students with dyslexia only have their dyslexia identified during their time at university (Singleton et al., 1999). Widening participation and alternative access arrangements for entry to university in the UK has increased the number of students from under-represented groups moving into university learning (e.g.: Mortimore, 2013), of which students with disabilities in whatever form is one, suggesting that the Singleton et al. (op cit) estimate seems likely to be if anything, lower than the true proportion of late-identified dyslexic students. This might further suggest that many progress to the end of their courses remaining in ignorance of their learning differences, and indeed it is likely that many will have gained a rewarding academic outcome in spite of them. One explanation for this late, or non-identification may be because these more, academic learning management-type dimensions of dyslexia which are components of self-regulated learning processes, are likely to have had little impact on earlier academic progress because school-aged learners are supervised and directed more closely in their learning at those stages through regulated teaching practices. At university however, the majority of learning is self-directed, with successful academic outcomes relying more heavily on the development of effective organizational and time-management skills which may not have been required in earlier learning (Jacklin et al., 2007).

Hence, because the majority of the existing dyslexia-identifying metrics appear to be weak in gauging many of the study skills and academic competencies, strengths and weaknesses of university students with dyslexia that may either co-exist with persistent literacy-based deficits, or have otherwise displaced them, this raised a concern about using any of the existing metrics *per se*. This is a concern shared by some educators working face-to-face with university students where there has been a recent surge in calls for alternative assessments which more comprehensively gauge a wider range of study attributes, preferences and characteristics (e.g.: Chanock et al., 2010; Casale, 2013). Thus for this current study it was felt that none of the existing evaluators would be able to accurately identify a dyslexic student from within a normative group of university learners - that is, students who include none previously identified as dyslexic nor any who are purporting to be dyslexic – or ascribe a measure of the dyslexia to the identification in a more finely graded way - that is, to establish a level of dyslexia-ness. Therefore, the development of a bespoke tool for gauging dyslexia-ness in its broadest context was considered necessary. The design of this needed to ensure that all students who used it felt that they were within its scope and that it would not reveal a set of study attributes that were either necessarily deficit- or disability-focused. Such tool needed to satisfy the following criteria:

* it is a self-report tool requiring no administrative supervision;
* it is not entirely focused on literacy-related evaluators, and attempts to cover the range of wider academic issues that arise through studying at university;
* it includes some elements of learning biography;
* its self-report stem items are equally applicable to dyslexic and to apparently non-dyslexic students;
* it is relatively short as it would be part of a much larger self-report questionnaire collecting data about the seven other metrics being explored in this research;
* it draws on previous self-report dyslexia identifiers which could be adapted to suit the current purpose to add prior, research-based validity to the metric;
* the results obtained from it will enable students to be identified who appear to be presenting dyslexia-like attributes but who have no previous identification of dyslexia – that is, *quasi*-dyslexic students.

The goal for this metric was to gauge a range of dimensions across a student's learning profile and attempt to quantify learning, study, and learning-biography attributes and characteristics which are known to exhibit differences between dyslexic and non-dyslexic individuals into a comparative measure. This could be used as a discriminator between students presenting a dyslexic, a *quasi*-dyslexic and a non-dyslexic profile out of two samples of university students, one group who have declared that they are dyslexic (the Control), and another who have declared no dyslexic learning differences. The metric was not intended to be an *identifier* of dyslexia as this would have raised ethical issues of disclosure. The measure is a coefficient and hence adopts no units. The tool that has been developed to generate the index value has been referred to as the Dyslexia Index Profiler, and Dyslexia Index will be frequently abbreviated to Dx. The literature review so far will have demonstrated unease with the use of the term 'dyslexia' as a descriptor of a wide range of learning and study attributes and characteristics that can be observed and objectively assessed in all learners in university settings. Notwithstanding these issues, in the interests of expediency, ‘dyslexia’ will be used throughout this study.

### VIII Dyslexia - summary

This first sub-section has attempted to present an overview of the syndrome of dyslexia at a sufficient level of detail, and to partially provide the theoretical underpinnings of this research project. It commenced by setting out the chosen definition for dyslexia that was considered to best match the stance of this project, and continued by briefly reviewing a selection of the most important theories about what dyslexia is and what its causes may be. It has been acknowledged that dyslexia is fundamentally about the communication skills and competencies of literacy, that is, reading, writing and spelling, especially in early-years learners. But an attempt has been made to demonstrate that a wide diversity of additional characteristics or dimensions can also be associated with the situation and circumstances of dyslexia. It has been shown that in university-level learners, it is often these other dimensions which may have a more significant impact on how students engage with their studies at university and hence how this may affect their confidence in their learning capabilities – that is, their academic confidence. This is because earlier literacy difficulties have often been strategically managed or accommodated into a learning profile and identity so as to have a reduced impact on learning that remains literacy-based. A polemic which runs through this discussion takes the position that were education and learning to have a more diverse range and scope in its curriculum delivery and assessment processes, and be less rigidly attached to literacy as a skill to be mastered so as to enable a learner to accurately demonstrate their knowledge or express their ideas, then individuals with dyslexic learning differences would be at less of a disadvantage in comparison with their peers. A shift towards the wider adoption of the ethos and principles of Universal Design for Learning has been strongly advocated, especially in HE contexts where firstly there is the scope for pedagogical processes to be more flexible and adaptable given sufficient impetus; and secondly, procedures for assessment could be more thoughtfully and less rigidly designed because they are less bound to nationally-devised outcome performance standards and indicators, endemic at lower levels of teaching and learning. By revising university teaching and learning in this way, students who present learning differences, whether dyslexic or otherwise, or alternative learning preferences or strengths that fall nearer the periphery of those considered as more typical, might be empowered to more effectively demonstrate their academic capabilities and become more confident students. The issue of academic confidence will be considered next.

## 2.2 Academic Confidence

### I Overview

Confidence is a robust dimensional characteristic of individual differences (Stankov, 2012). It can be considered as a sub-construct of self-efficacy where this is concerned with an individual's context specific beliefs about the capability to get something done (Bandura, 1995). Students who enter HE or college with confidence in their academic abilities to perform well, *do* perform significantly better than their less-confident peers (Chemers et al., 2001) and are likely to enjoy their studies more readily (Putwain et al., 2013). Research suggests that if individuals believe that they have no power to produce results then they will not attempt to make them happen (Bandura, 1997) and specifically, when students lack confidence in their capacity to tackle academic tasks they are less likely to engage positively with them (Pajares & Schunk, 2002). Academic confidence can be thought of as a mediating variable - that is, it acts bi-directionally - between individuals' inherent abilities, their learning styles and opportunities presented in the environment of HE (Sander & Sanders, 2003) and particularly when academic confidence is fostered as part of learning community initiatives, it can be an important contributor to academic success (Allen & Bir, 2012).

Thus, confidence can be regarded as students’ beliefs that attaining a successful outcome to a task is likely to be the positive reward for an investment of worthwhile effort (Moller et al., 2005). Conversely, in those for whom confidence in their academic abilities is weak, these learners can interpret the accompanying anxiety related to academic performance as a marker of their incompetence, although this may be an incorrect attribution which in turn, may lead to exactly the fear of failure that has generated the anxiety (Usher & Pajares, 2008). Perceptions of capability and motivation, which include judgements of confidence, feature significantly in self-concept theories; in particular, Social Cognitive Theory. This is where beliefs in personal efficacy are thought to be better predictors of academic outcomes than actual abilities or evidence from prior performance, because these beliefs are fundamental in establishing how learners are likely to tackle the acquisition of new knowledge and academic skills and how they will apply these productively, leading to positive and worthwhile outcomes (Pajares & Miller, 1995).

Social Cognitive Theory (SCT) enshrines these ideas and has been developed through decades of research and writing, particularly by Bandura (commencing: 1977). The underlying principle in SCT is that it is an attempt to provide explanations for the processes that drive and regulate human behaviour, according to a model of emergent interactive agency (Bandura, 1986). This is a model which attributes the causes of human behaviour to multifactorial influences derived principally from the reciprocal interactions between inherent personal characteristics, the local and wider environment that surrounds the domain of behavioural functioning, and the behaviour itself. As such, considerable interest in SCT has been expressed by educationalists and education researchers seeking to apply and integrate the ideas enshrined in the theory into a clearer understanding of the functions of teaching and learning processes, especially for making these more effective mechanisms for communicating knowledge and expressing ideas, and for interpreting the roots and causes of both academic failure and success.

Within this over-arching theory, the position of self-efficacy (and by inference, academic self-efficacy) as a social psychological construct that relates self-belief to individual actions is a central and fundamental element. Self-belief is a component of personal identity and some of the roots of Bandura’s theories can be traced to earlier work on personal construct theory asserting that an individual’s behaviour is a function of not only the ways in which they perceive the world around them, but more particularly how they construct their world-view in such a way that enables them to navigate a path through it (Kelly, 1955). Along this route from Kelly to Bandura can be found the Rogersian ‘person-centred approach’ which takes as its focus the concept of the ‘actualizing tendency’ – i.e. the basic human processes that enable the accomplishment of our potential by developing our capacities to achieve outcomes (Rogers, 1959). We can see the embodiment of this in HE through institutions seeking to adopt a ‘student-centred’ learning environment where the aim is to shift the focus from a didactic curriculum presentation to systems of knowledge delivery and enquiry which are more co-operative and student self-managed, with varying degrees of success (O’Neill & McMahon, 2005).

These underpinning arguments relating to human functioning have influenced the development of SCT by illuminating the mechanisms and processes that control and regulate the ways in which we behave and are about how human behaviour is controlled and regulated by how we think, what influences these thought processes, and how these are transformed into consequential behavioural actions. An overview of SCT will be presented next. As a bridge to the construct of academic self-efficacy and the sub-construct of academic confidence, this sub-section will continue with a brief review of the work of Zimmerman, Schunk and Pajares, whose research has been instrumental in relating SCT to educational contexts, concluding with a review of academic confidence, especially academic behavioural confidence, through the research and development work of Sander and others.

### II Underpinning Research Perspectives

#### An overview of social cognitive theory

The core of Social Cognitive Theory is about explaining human behaviour in the context of systems of self-regulation. Bandura argued that these systems were the major influences that cause our actions and behaviours. Emanating from his earliest writings, the principal idea is enshrined by a model of *triadic reciprocal causation* (see Figure 3) where the three interacting factors of personal influences, the environment, and action-feedback-reaction mechanisms that are integrated into all human behaviours act reciprocally and interactively as a structure that constitutes what is human agency – that is, the capacity for individuals to act independently and achieve outcomes through purposive behavioural actions. In this theory, individuals are neither entirely autonomous agents of their own behaviour nor are they solely actors in reactive actions that are driven by environmental influences (Bandura, 1989). Moreover, it is the interactions between the three factors that are thought to make a significant causal contribution to individuals’ motivations and actions. These are bound up with forethought based on past experiences and other influences - many being external - that precedes purposive action. This is to say that within the context of belief-systems, goal-setting and motivation, we all plan courses of action through tasks and activities that are designed to result in outcomes. None of our actions nor behaviours are random, despite evidence in earlier theories to the contrary which appeared to have demonstrated that such random behaviours are externally modifiable through stimuli of one form or another (e.g.: Skinner, 1953) or as more casually observed through the apparently variable and unpredictable nature of human behaviour. By thinking about future events in the present, motivators, incentives and regulators of behaviour are developed and applied. Bandura constructs his theory of the self-regulative processes around three core concepts: that of self-observation, judgmental processes, and self-reaction. Although a linearity is implied, these concepts are more likely to operate in a cyclical, feedback loop so that future behaviour draws on lessons learned from experiences gained in the past, both directly and through more circuitous processes. These are evident in self-reflective processes where, in order to influence our own motivations and actions we need to reflect on past performances. This is especially important in learning contexts and has been established as an important guiding principle in the blend of formal and independent learning processes that constitute curriculum delivery at university, in particular, where ‘reflective cycles’ are prevalent in numerous academic disciplines.

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Figure 3: A representation of the Triadic Reciprocal Causation model (adapted variously from bandura, 1977, 1982, 1989, 1991, 1997).

This is especially so in ones that involve an element of practice development such as nursing and teaching (e.g.: Wilson, 1996; Pelliccione & Raison, 2009). But the self-diagnostic function can be very important per se, not least because for those who are able and motivated to respond to the information acquired by reflective self-monitoring, behavioural change and/or modification of the respective environment, the potential for improving learning quality can be a valuable outcome (Lew & Schmidt, 2011, Joseph, 2009).

Being self-judgmental can be challenging, however, especially when doing so has a bearing on perceptions of personal competence and self-esteem because affective reactions (that is, ones that are characterized by emotions) that may be activated can distort self-perceptions both at the time and during later recollections of a behaviour (Bandura, 1993). But this does not alter the fact that observing one’s own pattern of behaviour is the first of a series of actions that can work towards changing it (ibid). First and foremost is making judgments about one’s own performance relative to standards. These can range from external assessment criteria to those collectively set by social and peer-group influences (Ryan, 2000) where the objective is to establish one’s personal standards with reference to the standards of the comparison group. Even within the framework of absolute standards that are set externally, social comparison has been shown to be a major factor that individuals refer to for judging their own performance, although these judgements can vary depending on which social comparison network is chosen (Bandura & Jourden, 1991). This seems likely to be highly significant in education contexts and might be taken to indicate that teacher-tutor efforts at raising the achievement standards of individual students should also be applied to the student’s immediate learning-peer-group; the outcome of this would be shared improvement throughout the group which should carry with it the desired improvement of the individual.

Performance judgements pave the way towards the last of Bandura’s three core components, that of self-reaction which is the process by which standards regulate courses of action. This is about the way in which personal standards are integrated into incentivisation or self-censure which is mostly driven by motivation levels based on accomplishment and the affective reactions to the degree to which success (or not) measures up to our internalized standards and expectations. In many domains of functioning there is abundant research to endorse the well-used cliché, ‘success breeds success’, with plenty of this in learning contexts. For example: supporting evidence has been found in university-industry learning-experience initiatives (Santoro, 2000), in mathematics teaching and learning (Smith, 2000), or in knowledge management and more business-oriented settings (Jennex, et al., 2009; Roth et al., 1994) with these studies reporting in one form or another, the positive impact of early- or first-initiative success on later-action success. Zimmerman (1989) reports that one of the most significant factors that differentiates between those who are successful in responding to their self-regulatory efforts and those who are not, is the effective utilization of self-incentives. We might imagine that this may be no-better illustrated than in the writing habits of PhD students who must depend on their own writing self-discipline because there is a much-reduced supervisory element at this level of study in comparison to lower degrees. Hence, developing writing incentives as part of the study-research process becomes instrumental to a successful outcome, with the most accomplished doctoral students likely to have developed the expected high-level study strategies early on. Indeed, there is now evidence to report that the process of ‘blogging’ as a means to provide writing incentives to university students is reaping positive benefits not least as online, personal study journals are likely to encourage extra-individual participation and self-reflection, and subsequently increase writing fluency (Zhang, 2009).

#### Self-efficacy in social cognitive theory and in learning

Based on much of his earlier work developing Social Cognitive Theory, Bandura turned his attention to the application of SCT to learning. The seminal work on self-efficacy (Bandura, 1997) has underpinned a substantial body of subsequent research in the areas of behavioural psychology and social learning theory, especially in relation to the roles that self-efficacy plays in shaping our thoughts and actions in learning environments. Self-efficacy is about the beliefs we have and the judgements we make about our personal capabilities and these are the core factors of human agency, where the power to originate actions for given purposes is the key feature (ibid, p3). Our self-efficacy beliefs contribute to the ways in which self-regulatory mechanisms control and influence our plans and actions, and hence, the outcomes that are the results of them. Bandura’s arguments about how self-efficacy impacts on effort, motivation, goal-setting, task value, task interest and task enjoyment can be usefully distilled into nine key points, additionally supported through the work of other researchers as cited. All points are highly pertinent in the domain of learning and teaching:

1. Individuals with a strong self-efficacy belief will generally attribute task failures to a lack of effort whereas those with much lower levels of self-efficacy ascribe their lack of success to a lack of ability (Collins, 1982);
2. Changes in self-efficacy beliefs have a mediating effect on the ways in which individuals offer explanations related to their motivation and performance attainments (Schunk & Gunn, 1986);
3. Self-efficacy beliefs also mediate the ways in which social comparisons impact on performance attainments (Bandura & Jourden, 1991);
4. Those who judge themselves to be more capable tend to set themselves higher goals and demonstrate greater commitment to remain focused on them (Locke & Latham, 1990);
5. Self-doubters are easily deterred from persisting towards goals by difficulties, challenges and failures (Bandura, 1991);
6. Conversely (to 5), self-assurance breeds an intensification of effort in the face of adversity or failure and brings with this, greater persistence towards success (Bandura & Cervone, 1986);
7. Self-efficacy makes a strong contribution towards the ways in which individuals ascribe *value* to the things they attempt (Bandura, 1991);
8. Individuals who present high levels of self-efficacy beliefs are more prone to remain interested in tasks or activities, especially ones from which they gain satisfaction by completing them and which enable them to master challenges (Bandura & Schunk, 1981);
9. Deep immersion in, and enjoyment of pursuits and challenges tend to be best maintained when these tasks are aligned with one’s capability beliefs, especially when success contributes towards aspirations (Csikszentmihalyi, 1979, Malone, 1981);

Thus, self-efficacy is broadly about judging one’s capabilities to achieve a goal and is integrated into many of the self-regulatory mechanisms that enable and facilitate the processes we need to engage in to accomplish things. That is, it is a construct that has functional characteristics and is a conduit for competencies and skills that enable positive outcomes. A function is a determinable mapping from one variable to a related dependent one, hence it is reasonable to suppose that outcome is a dependent function of self-efficacy, and that (academic) self-efficacy belief can be a dependent function of aptitude (Schunk, 1989). A typical, science student might comment, for example

“*Once I’ve got started on this essay about the role of mitochondria in cell energy factories I’m confident that I can make a pretty good job of it and finish it in time for the deadline”*

This student is expressing a strong measure of self-efficacy belief in relation to this essay-writing task and we should notice that self-efficacy is domain (context) specific (e.g.: Wilson et al., 2007; Jungert et al., 2014; Uitto, 2014). Task and domain specificity is considered in more detail below. For the science student, the challenges of the task have been considered and the evaluation integrated with perceived capabilities – in this case, capabilities about writing an academic essay based on scientific knowledge. Whereas outcome can be more obviously considered as a function of self-efficacy, conversely, self-efficacy belief may also be a function of outcome *expectations* because the essay writing task has not yet commenced or at least certainly is not completed. The student is projecting a belief about how successful the outcome will be for some point in the future and so it is reasonable to suppose that this may have an impact on the ways in which the task is approached and accomplished. This is an important point, however the bidirectionality of the functional relationship between self-efficacy beliefs and outcome expectations is not altogether clear in Bandura’s writings. In an early paper, it is argued that SCT offers a distinction between efficacy expectations and outcome expectancy:

“An efficacy expectation is a judgement of one’s ability to execute a certain behaviour pattern, whereas an outcome expectation is a judgement of the likely consequences such behaviour will produce” (Bandura, 1978, p240).

By including the phrase *‘*likely consequences‘, Bandura’s statement seems to be indicating that a self-efficacy belief precedes an outcome expectation and although these concepts seem quite similar they are not synonymous. For example, a student who presents a strong belief in her capacity to learn a foreign language (which is self-efficacy) may nevertheless doubt her ability to succeed (an outcome expectation) because it may be that her language class is frequently upset by disruptive peers (Schunk & Pajares, 2001) and this conforms to the correct sequential process implied in the statement above. The key idea according to Bandura and others such as Schunk and Pajares – who broadly take a similar standpoint to Bandura although acknowledge that the relationships between self-efficacy beliefs and outcome expectancy is far from straightforward – is that beliefs about the potential outcomes of a behaviour only become significant *after*the individual has formed a belief about their capability to execute the behaviour likely to be required to generate the outcomes (Shell et al., 1989). This is suggested to be a unidirectional process – that is, it cannot occur the other way around. This is important because it implies that self-efficacy beliefs *causally* influence outcome expectancy rather than proposing a bidirectional, perhaps more associative relationship between the constructs, or that there are circumstances when they may be mutually influential. Bandura provides a useful practical analogy to argue the point that self-efficacy beliefs more generally precede outcome expectations as he says:

"People do not judge that they will drown if they jump into deep water and then infer that they must be poor swimmers. Rather, people who judge themselves to be poor swimmers will visualize themselves drowning if they jump into deep water" (Bandura, 1997, p21).

This is also demonstrated in the conditional relationships between self-efficacy beliefs and outcome expectancies as Bandura sees them (Fig. 4).

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Figure 4: Conditional relationships between self-efficacy beliefs and outcome expectancies (Adapted from Bandura, 1997, p22).

However, a wider review of the literature shows that the evidence is conflicting from the start, because definitions of construct parameters are not universally agreed. In trying to establish exactly what is meant by an individual’s self-efficacy beliefs, understanding is clouded because the key parameter of ‘capability’, widely used in research definitions, must be relative to the domain of interest but is also necessarily subjective, based on the individual’s perception of their capability in that context. Thus, even in an experiment with a clearly defined outcome that seeks to discover more about participants’ context-based self-efficacy beliefs and their task outcome expectancy, the variability between participating individuals’ perceptions of their capabilities, even in the same context, would be difficult to control or objectively measure. This is because these are ungradable, personal attributes formed through the incorporation of a diversity of individualized factors ranging from social, peer-group and family influences (Juang & Silbereisen, 2002) to academic feedback reinforcement which can be both positive and negative (Wilson & Lizzio, 2008).

There is additional evidence from studies which appear to expose a deeper flaw in Bandura’s key argument, concisely summarized by Williams (2010), who seemed unsettled by studies’ blind adoption of theory as fact rather than being guided by the spirit of scientific research based on *nullius in verba*. In his paper (ibid), a case was built through the examination and citation of several examples of research which countered Bandura’s ‘fact’ that self-efficacy beliefs causally influence outcome expectancies in that direction only. Williams summarizes an argument about the causality of self-efficacy beliefs on behaviour that has remained unresolved for three decades, particularly through use of research by Kirsch (e.g. 1992) amongst notable others, which explored the impacts that incentivizing outcome expectancy has on perceptions of capability, that is, self-efficacy beliefs. Williams re-ignited the debate on whether or not self-efficacy beliefs can be attributed as a cause for behaviour without being influenced by expectations of possible outcomes that will result from the behaviour, or even that the complete process can just as likely occur the other way around.

We are therefore left with two uncertainties when seeking to use the principles of self-efficacy beliefs to explain individuals’ behaviour: the first is that operational definitions of attributes and characteristics of self-efficacy are difficult to firmly establish, particularly the notion of ‘capability’; and secondly, that Bandura’s underlying theory appears not quite as concrete as many researchers may have assumed. This is despite Bandura’s numerous papers persistently refuting challenges (eg: Bandura, 1983, 1984, 1995, 2007). So it seems clear that care must be exercised in using the theory as the backbone of a study if the outcomes of the research are to be meaningfully interpreted in relation to their theoretical basis. In particular, there seems some inconsistency about the operational validity of the self-efficacy<->outcome expectancy relationship in some circumstances, notably ones that may involve attributing the functional relationships between the two constructs into phobic behaviour situations where self-efficacy measures of (cap)ability are obfuscated by the related but distinct construct of willingness (Cahill et al., 2006). Given elements of phobic behaviour observed and researched in the domain of education and learning (e.g.: school phobias; for some useful summaries see: Goldstein et al., 2003; King et al., 2001; Kearney et al., 2004), consideration of this facet of self-efficacy belief theory to learning contexts should not be neglected.

In summary, it is useful to compare the schematic above (Fig. 4) which illustrates the unidirectional relationship from self-efficacy to outcome expectancies with Figure 5, modified for this research, based on a prior adaptation of Bandura’s writings in the same volume (op cit), which apparently suggests that a reversed causality direction can occur.

#### Dimensions of self-efficacy - level/magnitude, strength, generality

Efficacy beliefs in the functional relationship that link self-efficacy through behaviour to outcome expectations (and sometimes reciprocally as discussed above) have been shown through a wide body of literature supporting Bandura’s central tenets to be componential and we can think of the *level* or *magnitude* of self-efficacy expectations and the *strength* of self-efficacy expectations as the two primary dimensions. (Stajkovic, 1998). *Magnitude* is about task difficulty and *strength* is the judgment about the

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Figure 5: Illustrating a contradictory, uni-directional relationship from outcome expectancies to behaviour (adapted from Williams, 2010, p420).

* *MAGNITUDE*: whether you believe that you are capable or not …
* *STRENGTH*: how certain (confident) you are …

The essay-writing example used earlier demonstrates an instance of the capacity to self-influence, and in learning challenges the ways in which an individual reacts to an academic task is suggested to be a function of the self-efficacy beliefs that regulate motivation. It also provides an example of academic goal-setting – in this case, meeting the deadline – to which motivation, as another significant self-regulator mediated by self-efficacy, is a strong impacting factor, and to which significant associations between academic goal-setting and academic performance have been demonstrated (Travers et al., 2013; Morisano & Locke, 2013). However, expanding on this is for a later discussion, although Figure 6 attempts to illustrate how the dimensions of magnitude and strength might be working in relation to the example-task of writing an academic essay. Each quadrant provides a suggestion about how a student might be thinking when approaching this task and is related in terms

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Figure 6: Illustrating magnitude and strength of self-efficacy.

of their levels of perceived capability (magnitude) and confidence (strength) as dimensions of their academic self-efficacy beliefs.

In his original paper (1977) Bandura set out the scope and self-efficacy dimensions of magnitude and strength, and also the third dimension, ‘*generality’,* which relates to how self-efficacy beliefs are contextually specific or more widely attributable. The paragraph in this paper which provides a broad overview is presented verbatim (below) because it is considered useful to observe how confounding this earliest exposition is, and hence to reflect on how Bandura’s original thesis may have confused subsequent researchers due to the interchangeability of terms, words and phrases that later had to be unpicked and more precisely pinned down:

“Efficacy expectations vary on several dimensions that have important performance implications. They differ in magnitude. Thus when tasks are ordered in level of difficulty, the efficacy expectations of different individuals may be limited to the simpler tasks, extend to moderately difficult ones, or include even the most taxing performances. Efficacy expectations also differ in generality. Some experiences create circumscribed mastery expectations. Others instil a more generalized sense of efficacy that extends well beyond the specific treatment situation. In addition, expectancies vary in strength. Weak expectations are easily extinguishable by disconfirming experiences, whereas individuals who possess strong expectations of mastery will persevere in their coping efforts despite disconfirming experiences.” (Bandura, 1977, p194).

As an aside to trying to gain a clearer understanding of the message about level, strength and generality, it is of note that in this earliest of his writings on his theme, Bandura somewhat offhandedly speaks of ‘expectations’ which, in the light of the points made earlier, would be discomfiting were it not for later, clearer theses which relate the term to *outcomes,* with ‘efficacy *expectations‘*being subsequently referred to as *‘*perceived self-efficacy’ and ‘self-efficacy beliefs‘ – altogether more comprehensible terms. Indeed, in a later paper (1982) the phrase ‘efficacy *expectations’* occurred just once and was used in referring to changes in efficacy through vicarious experiences (more of this below). By the time of this paper, Bandura’s discursive focus had sharpened with the result that the ideas were less confusing for the researcher, easier to understand and more appropriately applicable.

#### Task / domain specificity

To follow through from the student imagined as facing a challenging essay-writing task it should be noted that self-efficacy is not necessarily a global construct and tends to be task-specific (Stakjovic, 1998). The student may think herself perfectly capable in essay-writing but consider that arguing the key points to peers through a group presentation quite beyond her. Examples from other domains as diverse as entrepreneurship (Kreuger & Dickson, 1994; Chen, et al., 1998), and journalism (Rooney & Osipow, 1992) suggest that measurable differences can be determined between *generalized* self-efficacy and self-efficacy related to sub-tasks within those wider domains. This indicates that there appears to be a need to distinguish between a measure that is adopted to gauge self-efficacy beliefs in a general *domain* to those related to specific tasks *within* that domain. Hence, the essay-writing student may present low self-efficacy beliefs related to the specific task of writing about the behaviour of mitochondria in cell energy factories, but be more efficacious when caused to reflect about studying more generally on her biological sciences course. Thus, even though the wealth of research evidence supports the *domain* specificity of self-efficacy and indeed within that, elements of *task*-specificity, an element of generality may still be apparent, to the extent that some researchers have persisted in attempting to take a more generalist viewpoint on self-efficacy. For example, Schwarzer and Jerusalem (1995) developed a General Self-Efficacy Scale which attracted further development and spawned validation studies by the originators and others throughout the following two decades (eg: Bosscher & Smit, 1998; Chen et al., 2001; Schwarzer & Jerusalem, 2010). An example of how it has been used is demonstrated by an extensive, cross-domain and cross-cultural investigation which, through a meta-analytic validation study, claimed general self-efficacy to be a *universal* construct and that it could be used in conjunction with other psychological constructs meaningfully (Luszczynska et al., 2004). An even more comprehensive meta-analysis using data from over 19,000 participants living in twenty-five countries also suggested the globality of the underlying construct (Scholz et al., 2002). Bandura has consistently doubted the veracity of research results which, he claims, misinterpret self-efficacy as a clear, narrow-in-scope construct and which hence try to justify the existence of a decontextualized *global* measure of self-efficacy. He especially cites the lack of predictive (for behaviour) capability that is weak when using a global measure as opposed to a specifically-constructed, domain-related evaluation, and that this ‘trait’ view of self-efficacy is thin on explanations about how the range of diverse, specific self-efficacies are factor-loaded and integrated into a generalized whole (Bandura, 2012, 2015).

#### Mediating processes in learning (academic) Self-Efficacy

An appealing characteristic of self-efficacy theory is that it is strongly influenced by an individual’s cognitive processing of their learning experiences (Goldfried & Robins, 1982). Hence, in the field of human functioning, but especially in learning processes, Bandura’s underlying arguments that efficacy beliefs are core regulators of the way we interact and engage with learning opportunities and challenges, are weighty and robust. His theories are supported by evidence that the process by which efficacy beliefs shape our learning is most strongly influenced by four, intervening agencies described as ‘mediating processes‘, which, although may be of individual interest, are processes which operate mutually rather than in isolation (Bandura, 1997). In this context, ‘mediating’ means where the action of a variable or variables affect or have an impact on the processes that connect ourselves with our actions – in this case, our learning behaviour.

These four mediating processes are:

* **cognitive processes** – where efficacy, that is, the capacity or power to produce a desired effect or action, and personal beliefs in it, are significant in enhancing or undermining performance;
* **motivational processes** – where, in particular, that through integrating these with attribution theory, the focus of interest is with explaining causality. In this way, theoretical frameworks are constructed which can find reasons that set apart otherwise similarly placed individuals but who take different approaches to (learning) challenges: At one end of the spectrum is the individual who attributes success to their personal skills, expertise and capabilities, and failure principally to a lack of effort. This individual is more likely to accept the challenges of more difficult tasks and persist with them, even in the face of a lack of successful outcomes. At the other end is the individual who may be convinced that their success or failure is mainly due to circumstances outside their control and hence, generally believes there to be little point in pursuing difficult tasks where they perceive little chance of success – generating a destructive sense of learned helplessness, an attribute which is known to be associated with dyslexia (Glazzard, 2010);
* **affective processes** – which are mainly concerned with the impacts of feelings and emotions in regulating (learning) behaviour. Significantly, emotional states such as anxiety, stress and depression have been shown to be strong effectors.
* **selective processes** – where the interest is with how personal efficacy beliefs influence the types of ((social) learning) activities individuals choose to engage with and the reasons that underpin these choices.

However, the most significant aspect of SCT when applied to a social construction of learning where academic self-efficacy is suggested to be one of the most important influential factors, are the four, principal sources of efficacy beliefs. Bandura (1997) identified these four source functions as: mastery experience; vicarious experience; verbal persuasion; and physiological and affective states:

**Mastery experience** is about successes won by building upon positive experiences gained through tackling events or undertakings, whether these be practical or physical, theoretical or cerebral. That is, experience gained through actual performance. But building a sense of efficacy through mastery experience is not about just applying off-the-peg, ‘coached’ behaviours, it appears to rely on acquiring cognitive processing, behavioural and self-regulatory skills that can enable an effective course of action to be executed and self-managed throughout the duration of an activity or life-action. For example, experience gained in essay-writing at university that steadily wins better grades for the student is likely to increase beliefs of academic self-efficacy – in essay-writing at least – whereas failures will lower them, especially if these failures occur during the early stages of study and do not result from a lack of effort or extenuating external circumstances; academic self-efficacy is widely regarded as domain specific in that it must be considered as relational to the *criterial*task (Pajares, 1996). However, although successes and failures are powerful inducers, Bandura reminds us that it is the cognitive processing of feedback and diagnostic information that is the strongest affector of self-efficacy rather than the performances per se (op cit, p81). This is because many other factors affect performance, especially in academic contexts, relying on a plethora of other judgements about capability, not least perceptions of task difficulty or from revisiting an historical catalogue of past successes and failures, and so personal judgements about self-efficacy are incremental and especially, inferential(Schunk, 1991).

However, the essay-writing student will have also formed a judgement of their own capabilities in relation to others in the class. In contrast to the absolutism of an exam mark gained through an assessment process where answers are either correct or not, many academic activities are perceived as a gauge of the attainment of one individual in relation to that of similar others. The influence that this has on the individual is **vicarious experience** and it is about gaining a sense of capability formed through comparison with others engaged in the same or a similar activity. As such, a vicarious experience is an indirect one, and even though generally regarded as less influential than mastery experiences, the processing of comparative information that is the essential part of vicarious experience may still have a strong influence on efficacy beliefs, especially when learners are uncertain about their own abilities (Pajares et al., 2007). A key aspect of vicarious experience is the process of ‘modelling’ by which an individual externalizes the outcome of the comparative processing into actions and behaviour that are aligned with the immediate comparative peer group. Thus, for students engaging in learning activities of which they have limited experience, their efficacy beliefs can be influenced by ways in which they perceive their peers to have achieved outcomes when working on similar tasks (Hutchison et al., 2006). In a sense, this is a kind of quasi-norming process by which an individual uses social comparison inference to view the attainments of ‘similar others’ as a diagnostic of one’s own capabilities. Hence, viewing similar others perform successfully is likely to be a factor in elevating self-efficacy, as equally the converse is likely to depress it. An element of self-persuasion acts to convince the individual that when others are able to successfully complete a task, a similar success will be their reward too. The influence of vicarious experience has been particularly observed in studies concerning the learning behaviours of children where although ‘influential adults’ are of course, powerful models for signalling behaviours, when ability is a constraint, the influences induced by comparison with similar peers can be more significant (Schunk et al., 1987).

An individual’s self-efficacy can also be developed as a consequence of the **verbal persuasion** of *significant others* who are relational to them. Verbal persuasion in the form of genuine and realistic encouragement from someone who is considered credible and convincing is likely to have a significant positive impact (Wood & Bandura, 1989). In teacher-training, the sense of teaching (self)-efficacy has been found to have a strong influence on teaching behaviour (not unsurprisingly) which is especially significant in student-teachers as they develop their classroom competencies and where encouragement gained from feedback and guidance from more experienced colleagues positively impacts on teaching practice confidence (Tschannen-Moran & Woolfolk Hoy, 2002; Oh, 2010). Additionally, in sport, there are a plethora of studies reporting the positive impact that verbal persuasion has on self-efficacy beliefs either through motivating ‘team talks’ presented by trainers or coaches (eg: Samson, 2014; Zagorska & Guszkowska, 2014) but also through actions of ‘self-talk’. However one interesting study reported that the greatest elevations of self-efficacy, collective efficacy and performance indicators were with individuals who practised self-talk verbal persuasion that took the group’s capabilities as the focus (Son et al., 2011).

Somatic study is an enquiry that focuses individuals’ awareness holistically and is inclusive of associated physical and emotional needs and where decisions are influenced and informed by an intrinsic wisdom (Eddy, 2011). If we understand ‘soma’ to mean in relation to the complete living body, then in the context of behavioural regulation, it means a process of *doing* and *being*. This is especially distinct from cognitive regulation of actions and decision-making – hence Eddy’s attribution of somatic enquiry to dance. The connection here to Bandura’s work is that in forming judgements about capabilities, individuals’ **physiological and affective states** are partially relied upon and Bandura proposes that whilst somatic indicators are more especially relevant in efficacy judgements about physical accomplishments – in physical exertion such as strenuous exercise for example - our corporeal state is the most significant gauge of achievement, (or not, depending on our level of fitness perhaps). Hence it influences our predictive ability to forecast likely future capacity and potential for further improvement – the ways in which our physiology reacts to, or anticipates situation-specific circumstances and how our emotions are interrelated with this *are* impacting factors on efficacy judgements. (Bandura, 1997).

Bandura was later taken by the idea of ‘mood congruency’ to support the argument about how affective states are able to directly influence evaluative judgements, (1997, p112, citing Schwartz & Clore, 1988). The most important idea concerns how individuals use a perception of an emotional reaction to a task or activity rather than a recall of information about the activity itself as the mechanism through which an evaluation is formed. Hence, positive evaluations tend to be associated with ‘good moods’ and vice versa although it is the attribution of *meaning* to the associated affective state which can impart the greater impact on the evaluative judgement. For example, a student who is late for an exam may attribute increased heart rate and anxiety levels to their lateness rather than associate these feelings to prior concerns about performing well in the exam – which in this case could possibly be a positive contributor to the likelihood of the student achieving a better result! Of more significance is that where mood can be induced, as opposed to being temporally inherent, a respective positive or negative impact on efficacy beliefs can also be observed, indeed the greater the intensity of mood that is evoked, the more significant the impact on efficacy becomes: individuals induced to ‘feel good’ exhibit more positive perceptions towards task characteristics and claimed to feel more satisfied with their task outcomes (Kraiger et al., 1989) which implies enhanced efficacy beliefs. More interesting still, is that mood inducement is reported to have a more generalized effect on efficacy beliefs rather than be directly connected with the domain of functioning at the time of the mood inducement (Kavanagh & Bower, 1985) which is clearly highly relevant in teaching and learning environments.

Contradictory evidence does exist, however, suggesting that in some situations, induced negative mood in fact increases standards for performance and judgements of performance capabilities because it lowers satisfaction with potential outcomes and hence, serves to raise standards (Cervone et al., 1994) – at least amongst the undergraduate students in that study. The argument proposed was that a consequence of negative mood was an evaluation that prospective outcomes would be lower and hence the level of performance that is judged as satisfactory, is raised, resulting in an outcome that is better than expected, suggesting the scenario of making students miserable so they try harder and hence achieve better results.

#### Agency

In more recent writing, Bandura has taken an agentic perspective to develop SCT (Bandura, 2001) in which 'agency' is the embodiment of the essential characteristics of individuals' sense of purpose. Sen (1993) argues that agency is rooted in the concept of capability, which is described as the power and freedoms that individuals possess to enjoy being who they are and to engage in actions that they value. Hence in adopting this perspective, the notion of capability becomes more crystalized as a tangible concept rather than as an elusive threshold one, as outlined above. Cross-embedded with capability is autonomy, with both being dimensions of individualism against which most indicators of agency have been shown to have strong correlations (Chirkov et al., 2003) in the field of self-determination theory (Ryan & Deci, 2000). Capability and, to a lesser extent, autonomy have been shown to be key characteristics for successful independent and self-managed learners (Lui & Hongxiu, 2009; Granic et al., 2009), especially in HE contexts where the concepts have been enshrined as guiding principles in establishing universities' aims and purpose, strongly endorsed by the Higher Education Academy some two decades ago (Stephenson, 1998). In this domain, Weaver (1982) laid down the early foundations of the 'capability approach' with strong arguments advocating the 6 Cs of capability - culture, comprehension, competence, communion, creativity, coping - that set to transform the nature and purpose of HE away from the historically-grounded didactic transmission of knowledge to largely passive recipients through a kind of osmotic process, into the kind of interactive, student-centred university learning broadly observed throughout tertiary education today. Capable learners are creative as well as competent, they are adept at meta-learning, have high levels of self-efficacy and can adapt their capabilities to suit the familiar, varied or even unfamiliar activities, situations and circumstances in which they find themselves (Nagarajan & Prabhu, 2015).  
  
Figure 7 draws from Bandura's extensive writings to summarize the components and factors which enable individuals' self-efficacy beliefs to move them towards a behavioural outcome. It can be seen that the picture is far from straightforward, but it shows that self-efficacy beliefs and performance as an accomplishment can be considered as precursors to

outcome expectancies and outcomes themselves. In the mix are control and agency beliefs, but of particular interest is the extent to which confidence might be considered as a strong agentic factor in the flow from self-efficacy and performance towards outcomes, especially in the light of evidence that this process is not as unidirectional as Bandura would have us believe. Nevertheless, Nicholson et al. (2013) suggested that confidence, in tandem with 'realistic expectations', were key drivers that can influence academic outcomes. Findings from their study supported their expectation at the outset that more confident students would achieve higher end-of-semester marks (ibid, p12), a point made at the start of this thesis.

A close up of a piece of paper

Description automatically generated

Figure 7: Summary of components and factors leading from self-efficacy beliefs to outcome expectancy (summarised from Bandura, 1997a, p23-26).

### III Social Cognitive Theory in Education and Learning

The application of SCT in the domain of education and learning has attracted a substantial body of research amongst educational psychologists, theorists and research-practitioners. Their interest has been in exploring self-efficacy beliefs as one type of motivational process in academic settings not least because motivation in learning has been widely accepted as one of the major contributing factors to academic achievement (eg: Pintrich, 2003; Harackiewicz & Linnenbrook, 2005).

Studies include for example, exploring motivation and academic achievement in maths in Nigerian secondary school students (Tella, 2007), achievement motivation and academic success of Dutch psychology students at university (Busato et al., 2000), motivation orientations, academic achievement and career goals of music undergraduates (Schmidt et al., 2006), academic motivation and academic achievement in non-specific curriculum specializations amongst Iranian undergraduates (Amrai et al., 2011) and in a substantial cohort (n = 5805) of American undergraduates (Mega et al., 2014). All these studies indicated positive correlations between academic achievement and motivation although it was also found that motivation in academic contexts can be a multidimensional attribute, succinctly observed by Green et al. (2006) in their extensive longitudinal study of secondary students (n = 4000) in Australia.

Zimmerman has also made a significant contribution to this discourse, emphasizing the idea of self-regulated learning as a central force that can drive academic achievement. Results have demonstrated that students who are efficient at setting themselves specific and proximal goals tend to gain higher academic rewards when compared with other, less self-regulated peers (Zimmerman, 2002). Hence becoming more self-aware as a learner is agentic in developing learning effectiveness (Zimmerman, 2001).

In reviewing the literature more carefully, three features of Zimmerman's research interests emerge that are significant. Firstly, both his own, and his meta-analyses of others' studies, generally focus on finding out more about whether learners display the specific attributes of initiative, perseverance and adaptability in their learning strategies and explore how *proactive* learning qualities are driven by strong motivational beliefs and feelings as well as metacognitive strategies (Zimmerman & Schunk, 2007); Secondly, a 'soft' conclusion is reached arguing that skills and strategies associated with self-regulated learning had to be taught to students in order for them to subsequently gain academic advantages and that such strategies were seldom observed as spontaneous or intrinsically derived (e.g.: Pressley & McCormick, 1995). This is interesting because it appears to support the approach adopted in UK HE institutions that academic 'coaching' is likely to enhance academic achievement and, anecdotally at least, this coaching appears ubiquitous throughout universities who enrol learners from a range of backgrounds with an equally diverse portfolio of academic credentials. What is not clear without deeper evaluation of the relevant literature, is whether academic coaching is a remedial activity focused on bringing 'strugglers' or those deemed as ‘learning disabled’ up to the required standard. Or conversely, in being repackaged as *learning development* or *academic enhancement*, coaching services are being more widely taken up by a much broader range of learners from the student community, or even whether the more general academic portfolio that learners are bringing to university is not a match for the challenges of the curriculum and hence demands learner upskilling. Another interpretation may be that as a result of recent government initiatives ostensibly to drive academic standards upwards through hierarchical university grading systems such as the Research Excellence Framework and the Teaching Excellence Framework (Johnes, 2016), it is in the business interests of universities to maximize the visibility of their academic 'standing' so that this can be used as a student recruitment initiative. In such circumstances, it might be argued that fostering a learning climate based on curiosity and inquisitiveness has been superseded by a need to ensure financial viability, even survival, in an uncertain economic climate in HE, and that the desire to attract students has led to a lowering of academic standards and an element of 'grade inflation' (Bachan, 2017)

The final observation is that in Zimmerman's and others' interest in developing devices to evaluate elements of self-regulated learning, these evaluative processes all seem to regard self-regulated learning as a global (learning) attribute and do not appear to have considered any domain specificity that may need to be accounted for. In other words, the assumption is that students’ study strategies are likely to be consistent across all their subject disciplines and no account is taken of differences that may be measurable in their approaches to say, maths or sciences in contrast to humanities. This is all the more interesting given the American roots of both Zimmerman's research and the evaluative processes that his studies have contributed to because the curriculum in US tertiary education tends to be broader than that in the UK at least, and so we might have expected that the opportunity to explore curriculum differences in self-regulated learning would have been exploited.

Building on earlier research about links between levels of achievement in academics and in sport (Jonker et al., 2009), McCardle et al. (2017) studied competitive pre-university athletes and found that those presenting high engagement metacognitive processes and variables in their sports were also highly engaged in their academic studies. As demonstrated above, this highlights the important point that within the umbrella of SCT, under which self-regulated learning resides, the co-associated construct of self-efficacy beliefs has been shown to be less general but more domain specific in not only learning contexts but in other areas of human functioning too. This example of self-regulation in sport may be an indication that high-engagement, self-efficacy beliefs can be a transferable learning approach. This is in keeping with the construct of academic confidence, considered as closely related to self-efficacy, but which appears to present as a more generalized learning attribute, with variances across disciplines, academic or otherwise, being less observable (Sander & Sanders, 2009).

It is also worth mentioning Schunk's contributions to research about the application of SCT to educational domains, particularly to learning more about the effects of social and learning-and-teaching variables on self-regulated learning, with a particular emphasis on academic motivation, framed through the lens of Bandura's theories of self-efficacy (Schunk, 1991). In this early paper (ibid), goal-setting is said to be a key process that affects motivation, and in learning contexts Schunk suggests that close-to-the-moment or 'proximal' learning objectives tend to elicit stronger motivational behaviours in children in comparison to more distant goals, an argument that is supported by a brief meta-analysis of other studies. In young learners at least, Schunk finds that elevated motivation towards proximal learning goals is observed because students are able to make more realistic judgments of their progress towards these, whereas distant objectives by their very nature require a much more 'regulated' approach - hence the interest and connection with self-regulated learning. Schunk also indicates that a significant difference in levels of motivation can be observed between target goals that are specific rather than general. For example, this might be where an assessment requires a student to achieve a minimum mark in comparison to where a more general instruction to 'do as well as you canis provided as the target (ibid, p213). These are conclusions that are also evidenced in earlier studies: for example, in their meta-analysis of research of the previous two decades, Locke et al. (1981) found that in 90% of the studies they considered, higher motivational levels of behaviour and subsequent performance were demonstrated towards specific goals when compared with targets that were easy to achieve, or learners were instructed to 'do your best', or no goals were set at all.

Schunk also showed interest in the social origins of self-regulative behaviours in learning contexts through an interesting study which considered self-regulation from a social cognitive perspective. It was noted that through this lens, it can be shown that students' academic competencies tend to develop firstly from social sources of academic skill. This idea draws on earlier and much vaunted sociocultural learning theory, typically attributed to Vygotsky's thesis about the zone of proximal development, which is where learners are said to develop academic capabilities through supportive associations with their peers as much as through a teacher. Academic competency acquisition then can be shown to progress through the four stages of observational, imitative, self-controlled and finally self-regulated learning (Schunk & Zimmerman, 1997). The authors recommended that further research should be conducted, not least into how peer-assisted learning strategies might be established in learning environments and we have witnessed the legacy of this idea in universities where many such initiatives have been established in recent years. Advocates of such programmes cite studies which support their benefits in terms of improved grades and skills development (e.g.: Capstick et al., 2004; Hammond et al., 2010; Longfellow et al., 2008). This has been especially true in medicine and clinical skills education where a development of peer-assisted learning, that of problem-based learning (PBL), actively generates learning through collaborative student learning enterprises.

Finally, it is pertinent to include a brief overview of the substantial contribution to SCT in education made by Pajares. His early research explored 'teacher thinking' and in particular, how teachers' beliefs about their work, their students, their subject knowledge, their roles and responsibilities could each or all impact on educational processes, not least the learning quality of their students. The core point to be drawn was that teachers' beliefs should become an important focus for educational enquiry, so as to contribute more fully towards understanding learning processes and engagement with education (Pajares, 1992). This early line of research was supplanted with a deeper interest in self-efficacy beliefs and especially how these related to mathematical problem-solving in adolescents. A useful paper tried to establish key differences between math self-efficacy and self-concept, finding that self-efficacy was a better predictor for problem-solving capabilities than other constructs, notably prior experience of maths, and gender, in addition to math self-concept (Pajares & Miller, 1994). Other papers exploring the relationships between maths self-efficacy beliefs and performance predictors showed support for Bandura's contention that due to the task-specific nature of self-efficacy, measures of self-efficacy should be closely focused on the criterial task being explored and the domain of function being analysed (Pajares & Miller, 1995). It is in these and other, related papers not only with a mathematics focus but also exploring the influences of self-efficacy beliefs on student writing, (eg: Pajares, 1996b, Pajares & Kranzler, 1995, Pajares & Johnson, 1995) that we see Bandura's self-efficacy theories enshrined and used to underpin much of Pajares' writing, not least drawn together in an important summary paper that sought to more generally apply Bandura's ideas to educational, academic settings (Pajares, 1996a) which also acted as a prequel for Pajares' deeper interest in the developing idea of academic self-efficacy.Work of a slightly later period focused on maths self-efficacy in US undergraduates. For example, one study conducted a review of a previously developed Maths Self-Efficacy Scale (MSES - Hackett & Betz 1982) which is of interest to this project because it applied factor analysis to the scale's results when used with a sizable cohort of undergraduates (n = 522) (Kranzler & Pajares, 1997). Although the MSES had become a widely used and trusted psychometric assessment for establishing the interrelationships between maths self-efficacy and, for example, maths problem-solving, Kranzler and Pajares argued that looking at the factor structure of the scale is an essential process for gaining an understanding of the sources of variance which account for individual differences, claiming that this is required to substantiate results. The point is that through this statistical procedure, Pajares and collaborators have shown a clear understanding of the multidimensional aspects of, in this case, maths self-efficacy but also the pertinence and value of factor analysis being applied to local study-captured data. It was also interesting to note that for this study at least, Kranzler and Pajares' analysis led to their claim for the identification of a general measure of self-efficacy which is at variance with Bandura's contention that self-efficacy beliefs are quite clearly context-specific (Bandura, 1997). It is also at variance with one of Pajares' own earlier studies (Pajares & Miller, 1995) which argued for context specificity if research outcomes are to be considered reliable and valid. It is of note that in that study (ibid, 1995), the cohort of 391 undergraduate students' self-efficacy judgement were assessed according to three criteria: confidence to solve mathematical problems, confidence to succeed in math-related courses, and confidence to perform math-related tasks. Sanders' later (2006) contention is that (academic) confidence is a sub-construct of (academic) self-efficacy and although similar, the differentiation is necessary, and so we are left to consider that Pajares and Miller's study was in fact assessing maths self-confidence rather than maths self-efficacy albeit on the basis that this small but important distinction was yet to emerge. Key to this summary of Pajares' research output and contribution to self-efficacy theory in educational settings is more recent research and summary papers which sharpen his area of interest into the emerging field of academic self-efficacy (e.g.: Pajares & Schunk, 2002). It is this sub-construct of self-efficacy that is the umbrella construct for academic confidence, operationalized as Academic Behavioural Confidence, as the dependent variable to which connections will be established with dyslexia so not to lose focus on one of the key objectives of the project: to establish that the process of identifying dyslexia in whatever form we may choose to define it in HE contexts will impact on the academic confidence of students at university thus labelled.

### IV Academic Behavioural Confidence

Academic Behavioural Confidence (ABC) is the key metric being used as the dependent variable in the data analysis for this research study. Measures obtained through the application of the ABC Scale to the three, research subgroups in this study are interesting because outcomes derived from the analysis may be suggesting that identifying dyslexia has a negative impact on academic confidence and hence possibly on academic achievement, even though no research evidence o date shows that absolute scores of ABC are directly linked to absolute academic outcomes such as degree classification or grade point averages. It is suggested that a study to directly explore this possible use of ABC as a predictor of academic outcome is overdue, especially amongst groups of students conventionally considered as being under-represented at university.. However, it is considered that this study offers a valuable contribution to the field of research, especially since it will be reported later that the comparison of ABC values between the three research subgroups in this project clearly demonstrates that for this research datapool at least, the ABC of students with dyslexia is not only statistically lower than for non-dyslexic students, but also lower than for students with unreported dyslexia-like profiles.

#### Historical development of the Academic Behavioural Confidence Scale

In her doctoral dissertation, Decandia (2014) looked at relationships between academic identity and academic achievement in low-income urban adolescents in the USA. Although briefly reporting on the original Academic Confidence Scale developed by Sander and Sanders in 2003, her study used neither that metric, nor the more recently developed version – the Academic Behavioural Confidence Scale – but instead, an Academic Confidence Scale originating in a near-twenty-year-old doctoral thesis (McCue-Herlihy, 1997), which Decandia developed as “an organic measure of confidence in academic abilities” (op cit, p44). This earlier thesis does not appear to have been published and thus remains lodged in its home-university repository. However, it would be of interest, as McCue-Herlihy’s Academic Confidence Scale appears to be the first time such a metric was constructed. It is assumed that it was created to contribute to gauging how the elements self-efficacy, academic achievement, resource utilization and persistence might be interrelated in a group of non-traditional college students. Hence McCue-Herlihy's work, presumably suggesting a measurable connection between confidence and routes towards achievement in academic study, appears to have pre-dated Sander's development of the Academic Confidence Scale.

Sander's scale was designed and used to explain the differences in students’ expectations of the teaching-and-learning environment of university (Sander et al., 2000). The research group in this first study consisted of medical students (n=167), business studies students (n=109) and psychology students (n=59), each studying at a different university. Aside from results and discussion that were specifically pertinent to this study, the construct of academic confidence was proposed as a possible explanation for significant differences in groups’ preferences in relation to role-play exercises and peer-group presentations as approaches for delivering the respective curricula. In particular, the medical students and the psychology students both expressed strong negativity about these teaching approaches, but it was the difference in reasons given that prompted interest: the medical students argued that neither of these teaching approaches were likely to be effective, whereas the psychology students attributed their views about the ineffectiveness of both approaches more to their own lack of competence in participating in them. Sander et al. suggested that these differences may have arisen from students' levels of academic confidence, possibly arising out of the different academic entry profiles of the two groups.

The idea of academic confidence was developed into a metric, the Academic Confidence Scale (ACS - Sander & Sanders, 2003), where academic confidence was conceptualized as the extent to which university students express strong belief or sure expectation about what the university learning experience will offer them. Hence academic confidence is a less domain-specific construct than academic self-efficacy and Sander's rationale for developing a distinct metric for exploring academic confidence had been a consequence of practitioner observations about how university teaching regimes and artefacts appear to influence student learning behaviours. This is significant for the researcher as it means that the metric can be used to explore attitudes and feelings towards study at university without these being in relation to a particular academic discipline or a specific academic competency – for example, dealing with statistics or writing a good essay. Underpinning academic confidence as a sub-construct of academic self-efficacy, this later study set out to explore the extent to which academic confidence might interact with learning styles and impact on academic achievement. Sander and Sanders argue that academic confidence is a “mediating variable between an individual’s inherent abilities, their learning styles and the opportunities afforded by the academic environment of HE” (ibid, p4). For that investigation, two further groups of medical and psychology students were recruited (n=182, n=102 respectively) although rather than attempt to relate their evaluation of the students' academic confidence to particular teaching artefacts or learning interventions, the aim of this research was to explore changes in academic confidence between two time-points, presumably to gain an insight into the impact that the university teaching and learning environment had on their levels of academic confidence although this was not a clearly stated aim. Findings revealed that academic confidence was moderated by academic performance rather than acting as a predictor, and for these students at least, their studies appeared to have commenced with unrealistic expectations about their academic performance and this was tempered by actual academic assessment outcomes. However, as a result of this study, construct validity was established for the ACS and a preliminary factor analysis was conducted although differences between the factor loadings for the two student groups led the researchers to conclude that analysis on a factor-by-factor basis would be inappropriate in that study, although as we will see, the process of dimensional reduction was returned to later.

Research interest in the Academic Confidence Scale in this early period was modest. Of the 18 studies found, these included an exploration of music preferences amongst adolescents, relating these to personality dimensions and developmental issues (Schwartz & Fouts, 2003), to a study exploring university students’ differences in attitudes towards online learning using the Academic Confidence Scale in a longitudinal survey to gauge student engagement with an online health psychology module before and after the module was completed (Upton & Adams, 2005). Lockhart’s (2004) study explored attrition amongst university students and was the first to explore the phenomenon using a sample of student drop-outs, matched with students remaining at, and students who had left university. The Academic Confidence Scale was used to explore how different levels of confidence were related to student expectations of HE. One of the findings determined academic confidence to be a significant contributor to attrition although it was acknowledged that many other factors also had a strong influence on students’ likelihood of leaving university study early. Lockhart’s results also appeared to indicate academic confidence to be a transitory characteristic which is affected by the most recent academic attainments. This is consistent with the idea of academic confidence as a malleable characteristic, suggested earlier through Sander’s original research and more strongly proposed in a later, summary paper (Sander et al., 2006a). In a study similar to Lockhart’s, also into student retention and likelihood of course change, Duncan, (2006) integrated five items from the Academic Confidence Scale into the research questionnaire to explore the mediating effect of academic confidence on the relationship between academic ability and academic integration, although no reasons for identifying these specific items from the full ACS as being particularly appropriate were offered. It is possible that the reason was simple expediency for reducing the questionnaire to a manageable size even though it still comprised 151 scale items. Results indicated low academic confidence to be strongly correlated with course-change or drop-out intention.

Of the remaining studies that included or implied use of the Academic Confidence Scale, all were either conducted by Sander, usually with colleauges, or Sander appears to have been a contributing author. This collection of studies includes Sander’s own doctoral thesis (Sander, 2004) which explored the connections between academic confidence and student expectations of their university learning experience and built on the original project for which the Academic Confidence Scale was developed. The thesis comprised the author’s prior, published works which were all concerned with exploring students’ expectations and preferences towards teaching, learning and assessment at university. These early studies increased research assurances about the use of academic confidence to explain differences in students’ learning preferences with the findings providing evidence that teaching institutions should attempt to gain a greater understanding of their students as learners in order for their teaching regimes, artefacts and processes of curriculum delivery to be more effective (Sander, 2005a, Sander, 2005b). This was pertinent in the university climate of a decade or so ago when student numbers increased to record levels through a variety of initiatives, not least the emergence of widening participation as a social learning construct in education and the greater diversity of students that this and other new routes into HE through foundation and access courses was bringing to the university community. An apparent consequence of this however, appeared to be greater attrition rates (e.g.: Fitzgibbon & Prior, 2003; Simpson, 2005) leading to research attention being directed towards finding explanations for increasingly poor student retention with academic confidence being linked to students terminating their courses.

The scale was renamed the Academic Behavioural Confidence (ABC) Scale to recognize that it is more properly a gauge of confidence in actions and plans in relation to academic study behaviour (Sander & Sanders, 2006b), but in all other respects the metric was unchanged. Later studies using the ABC Scale augmented the theory that academic confidence is a sub-construct of academic self-efficacy, arguing that the ABC Scale bridges the gap between self-efficacy and self-concept measures (Sander, 2006). As with earlier studies, the research was exploring ways to improve university teaching by understanding more about students’ attitudes towards teaching processes commonly used to deliver the curriculum. For example, findings revealed significant differences in post-presentation academic confidence which were attributed to whether the presentations were assessed or not assessed, with measurable gains in ABC being recorded following presentations that were assessed. Of particular interest in the discussion was an item-by-item analysis of ABC Scale statements enabling a better understanding of participant responses to be gained. This indicates that although ABC is designed to be a global measure of academic confidence, by exploring specificity, as revealed by comparisons taken from items within the scale, this can reveal detailed academic confidence profiles. Conclusions suggested that where self-efficacy measures stress the significance of mastery experience as a major part of the establishment and maintenance of efficacy beliefs - hence drawing on the underlying themes of Bandura's Social Cognitive Theory - these may not take a sufficient account of the wider socio-educational components in university study that affect students' concepts of themselves as learners, whereas the sub-construct of academic confidence is more able to do this.

Arguing that females generally lack academic confidence and that males are more likely to rate their academic abilities more highly than female students, subsequent studies used the ABC Scale to explore gender differences in student attitudes towards the academic and the non-academic aspects of university life (Sander & Sanders, 2006b; Sander & Sanders, 2007; Sanders et al., 2009). Although these studies’ findings indicated little significant difference between ABC scores of males and females overall, detail differences on an item-by-item basis did emerge. For example, it was shown that male students were significantly less likely to prepare for tutorials and also less likely to make the most of studying at university in comparison to their female peers, especially in the first year of study. Although this was initially explained as possibly revealing a measure of over-confidence in males’ expectation of academic achievement, it was noted that this perception was not displaced later, as actual academic achievement was comparable overall to that achieved by females, suggesting that males saw themselves as able to achieve as good a result as females but with less work, with poorer organization and less engagement with teaching sessions. These findings demonstrate the value of examining ABC Scale outcomes in detail in addition to drawing conclusions based on overall scores. This appears to have prompted a deeper interest in the *structure* of the ABC Scale. A later study used factor analysis (Principal Component Analysis (PCA)) to search for subscales in the main scale (Sander & Sanders, 2009) with the claim that were these revealed, this may lead to a more satisfying explanation of unexpected lack of differences in academic confidence when examining the between-groups scores in earlier studies. This process had been applied to data in earlier studies, resulting in six subscales being suggested: Grades, Studying, Verbalizing, Attendance, Understanding, and Requesting. Out of the later application of PCA to the combined datasets from their previous studies (ntotal=865) the same six subscales initially emerged, although through further, structural equation modelling, a revised, four-factor structure which more accurately reflected the most likely nature of the complete ABC Scale was suggested. These were designated: Grades, Verbalizing, Studying, and Attendance, and following further analysis exploring scale-item redundancy, the original 24-item scale was reduced to 17 items, a reduction which was later validated with a substantial sample of university students (n=2065) (Sander et al., 2011). The findings from that research were used to suggest that the ABC Scale can be helpful in gaining an understanding of students' orientation to their studies, notably as a diagnostic tool to aid tutors in creating more effective learning opportunities.

Meanwhile, other studies using the ABC Scale were beginning to emerge, possibly as a result of more widespread interest in a paper presented Sander and Sanders, (2006a) which drew useful comparisons between attributes of the related constructs of academic self-concept, academic self-efficacy and ABC, grounded in theories of academic motivation (Bong & Skaalvik, 2003). Table 1 summarizes the three constructs’ dimensions and components:

|  |  |  |  |
| --- | --- | --- | --- |
| Comparison dimension | Academic self-concept | Academic self-efficacy | Academic Behavioural Confidence |
|  | | | |
| Working definition | Knowledge and perceptions about oneself in achievement situations | Convictions for successfully performing given academic tasks at designated levels | Confidence in ability to engage in behaviour that might be required during a (student) academic career. |
|  | | | |
| Central element | Perceived competence | Perceived confidence | Confidence in abilities |
|  | | | |
| Composition | Cognitive and affective appraisal of self | Cognitive appraisal of self | Assessment of potential behavioural repertoire |
|  | | | |
| Nature of competence evaluation | Normative and ipsative | Goal-referenced and normative | Response to situational demands |
|  | | | |
| Judgement specificity | Domain specific | Domain specific and context specific | Domain and narrowly context specific |
|  | | | |
| Dimensionality | Multidimensional | Multidimensional | Multidimensional |
|  | | | |
| Structure | Hierarchical | Loosely hierarchical | Flat and summative |
|  | | | |
| Time orientation | Past-oriented | Future-oriented | Future-oriented |
|  | | | |
| Temporal stability | Stable | Malleable | Malleable |
|  | | | |
| Predictive outcomes | Motivation, emotion and performance | Motivation, emotion, cognition and self-regulatory processes and performance | Motivation, coping, help-seeking and performance |
|  | | | |
| (Sander & Sanders, 2006a, Table 1, p36; adapted from Bong & Skaalvik, 2003) | | | |

Table 1: Dimensions and components of academic self-concept, academic self-efficacy and Academic Behavioural Confidence.

This comparison of dimensions demonstrates a cascade relationship between academic self-concept, academic self-efficacy and academic behavioural confidence. For example, where academic self-concept can be thought of as how an individual holds self-knowledge and self-perceptions in broad, academic outcome-driven situations, such as studying at university - within this will be held beliefs about performance in a particular academic task at a specified level - say, constructing a final-year dissertation - in order to accomplish this academic outcome, levels of confidence in engaging in the academic activities necessary to accomplish the task are functions of those academic activities. In a dissertation task, this may be a student's level of confidence about how likely they are to be able to work out how to construct their primary argument without recourse to tutorial assistance.

#### Recent research using the ABC Scale

Since Sander's re-launch of his Academic Confidence Scale as the Academic Behavioural Confidence (ABC) Scale (Sander & Sanders, 2006a) to date, 25 studies have been found which use the ABC Scale, all conducted with participants in HE. Although ranging quite widely in their foci, all were concerned with using ABC as an evaluator of pre- post- interventions in academic enhancement or engagement programmes, for example, using the metric to assess the effectiveness of new approaches to teaching (Keinhuis et al., 2011; Keinhuis et al., 2013; Nicholson et al, 2013); or to evaluate initiatives such as peer- and other mentoring schemes (Chester et al., 2010; Miller 2015); or using new technology (pod-casts or other online learning devices) as a teaching-and-learning artefact, finding that students who widely used these demonstrated slightly elevated academic self-efficacy; or were interested in exploring specific aspects of students’ approaches to their studies - for example, to demonstrate the unpreparedness of access students for wider university programmes (Hlalele, 2010); or finding greater study resilience amongst older students in comparison to their younger peers (McLafferty & McCauley, 2012) or how academic ‘grit’ (resilience) positively contributes to academic achievement (DeCandia, 2014). Sanders, Daly and Fitzgerald (2016) used the ABC Scale to explore foundation year students' expectations of their academic performance and achievement specifically to determine whether the levels of academic behavioural confidence might forecast attrition and hence be an early indicator of the need for learning development interventions. Findings showed that low scores on the ABC subscales, ‘attendance’ and ‘grades’ were good predictors of subsequent likely learning difficulties, with another study demonstrating that starting a learning course with a realistic expectation of a successful outcome is more likely to lead to a successful outcome (Sanders, Mair & Racheal, 2016). Other studies used ABC to set baseline measures (Hlalele, 2012) or as a profiling tool (Sander et al., 2014) for developing targeted learning development initiatives; or explored transience in students’ academic confidence as they progress through their studies at university, where one study showed those with high levels of ABC over-predicted their final grades, suggesting that guidance to ‘re-calibrate’ academic confidence levels should be offered to students as they develop their study skills and gain academic experience (Wesson & Derre-Rendall, 2011). Another study also demonstrated how students’ ABC were malleable, showing that students who developed higher levels of ABC as their studies progressed gained better final grades, as did those whose academic expectations were focused and realistic (Putwain et al., 2013), with a further study showing that students’ confidence declines during the first year of study due to unrealistic expectations about the academic challenges of their courses. However, by using a system of ‘achievement goal profiling’, students could be guided towards ‘mastery’ goals by developing their academic competence in study-related cognitions and behaviours such as effort, persistence, help-seeking, and planning, compared to settling on ‘performance’ goals, which relied on (academic) comparisons with peers. This demonstrated that early decline in academic confidence could be ameliorated with such interventions. A significant, further study (n=2429) reiterated Bandura's (2008) argument that there is a bidirectional relationship between [academic] self-efficacy and [academic] performance (de la Fuente, et al., 2013), finding that academic performance influences academic self-efficacy through mastery experience, and that students with high levels of self-efficacy tend to perform better. The study's outcome further concluded that academic confidence, as one aspect of academic self-efficacy, can be a realistic predictor of academic performance, although added that it is not the only predictor with other factors, notably prior achievement, having a significant effect. In the same vein, a later study was grounded in trying to understand which student learning factors might influence teaching and learning parameters so that ways to enhance student academic performance might be suggested (Sander, Putwain & de la Fuente, 2014). Findings suggested that although academic confidence was an important factor, it was amongst others such as [academic] expectations, emotional stability, and the ‘person-environment fit’. Interpretation of the meaning of academic confidence was that it is an academic self-efficacy measure that assesses more general academic capabilities through exploration of behaviours in academic learning management and study-skill competencies, rather than a more specific. self-efficacy measure which might attempt to gauge confidence to achieve a particular grade target or other clearly defined academic achievement criteria. Hence, that academic confidence, when operationalized as Academic Behavioural Confidence, should be considered more as a multi-dimensional construct rather than as a uni-dimensional one. A recognition of the multi-facetedness of the processes that are mutually interacting in teaching and learning spaces were strongly advocated, notably, these were the relationships between student self-regulated learning processes and those which are external and regulatory as part of the construction of teaching. It was thus argued that ABC is a useful metric for profiling individual learners so that individualized and highly targeted learning development interventions can be designed in response to specific scale-item responses in the ABC Scale. A related study had explored confidence in study-related skills and behaviours amongst undergraduates (n=206), aiming to relate levels of ABC to academic achievement (Putwain et al., 2013). It was found that academic self-efficacy can be usefully assessed by gauging self-efficacy in self-regulated learning - which is the principle concern of the ABC metric - and that this is then a good predictor of future academic performance. This study also highlighted the value of information derived from the ABC subscales as a means to hone analysis conclusions more specifically. For example, findings showed that levels of students' readiness to engage in the various kinds of study-related skills and behaviours which are required on their courses and which are assessed by the subscales, were strong predictors of their subsequent academic success at the end of their first year. It was also argued that academic learning management information gained about new undergraduates could be useful for designing learning development initiatives that focus on developing perceptions of their own abilities for grounding them at more realistic levels at the beginning of their courses, supporting other studies’ findings (above).

The summary of literature so far demonstrates the increasing interest in academic behavioural confidence as a construct worthy of research in tertiary learning contexts. The design rationale of the ABC Scale as an evaluator of student study behaviours is rooted in a strong theoretical background stemming from Bandura's widely accepted Social Cognitive Theory and the metric adds to a body of research in support of measuring academic confidence to find out more about how non-cognitive learning parameters impact on student learning effectiveness, and ultimately, their academic achievements at university. Such was the premise that underpinned a substantial meta-analysis (Braithwaite & Corr, 2016) which drew its research rationale from the work of Eysenck. Although principally a personality theorist, Eysenck also wrote on the relationships between personality and learning, indicating an emphasis for empirical, experimental studies of the effectiveness of education design and pedagogy, that is, how learners' personalities might influence their reactions to specific methods of teaching and the learning environment, and hence how this might impact on their academic attainments (e.g.: Eysenck, 1996). Brathwaite and Corr's meta-analysis looked at 47 studies (ntotal = 5771) that were all interested in testing methods of enhancing university student self-efficacy and self-confidence attributes as a means to influence a range of academic outcomes. Whilst it must be recognized that the process of combining data from multiple studies has the advantage of creating a much larger datapool, a cautious approach must be adopted to ensure that the parameters being explored in the combined data are as close as possible to those originally measured in each individual study. Ignoring this, not least because studies are rarely exact replications of each other, runs the risk of introducing bias and reducing the credibility of the outcome (Egger et al., 1997; Card, 2015). Notwithstanding this, the meta-analysis reported small to moderate but statistically significant positive effect sizes across all of the domain outcomes examined, notably in respect of supporting the usefulness of the ABC Scale a significant positive correlation was identified between ABC score and final degree outcome. This was consistent with a much earlier meta-analysis of 39 studies (Multon et al., 1991), which found a statistically significant relationship between self-efficacy and academic performance, although in citing this earlier study, Braithwaite and Corr indicated that because Multon and colleagues had included results from some non-experimental (observational) studies on learning development interventions designed to enhance student self-evaluation processes to impact on a range of university-outcome-capabilities, caution should be adopted in drawing too much from the findings. However, the significance of both of these meta-analyses, caution accepted, is the emergence of evidence that indicates that student learning behaviours, including academic learning management activities, are additional to absolute ability in influencing academic outcomes at university.

Finally, recent use of the ABC Scale took an unusual approach by exploring levels of academic confidence, operationalized through measuring Academic Behavioural Confidence, in relation to past academic experience (Hill, 2017). This enquiry conceptualized prior academic experience as 'academic sustenance' and the research aim was to establish that (current) academic confidence is a function of academic sustenance which Hill determined in her study of Australian undergraduates (n=255) is comprised of 4 factors: encouragement, drive, grounding, and efficacy. Central to Hill's enquiry was advocacy of the increasing importance of understanding more about how university students approach their studies, citing such research areas as motivation and self-efficacy as key elements of successful learning approaches, also arguing for a greater focus to be placed in institutions on more pro-actively developing academic competencies such as critical thinking abilities and multiple timeline academic learning management skills. Aside from this ethos resonating significantly with the research project reported in this thesis, Hill's use of the ABC Scale is the only one found to date where a study-specific principal component analysis was conducted on the results generated from the application of Sander and Sanders' complete, ABC Scale to the participant cohort, rather than adopting the existing and by now, widely used 4-factor subscales generated from Sander and Sanders' PCA analysis of their own data. As described later, this process of study-specific PCA on data collected through the ABC Scale has been used in the current research project due to being equally unconvinced that the adoption of the 'standard' 4-factor model for determining subscales of the ABC Scale could offer the best analysis outcomes.

In summary: the ABC Scale has featured in numerous research studies since its development into its current form in the early 2000s. It has been used in studies of university students to explore the contribution that non-cognitive factors may make on the self-regulated learning approaches that are widely expected in HE settings. Some studies have used the scale to evaluate temporal changes, either as a natural course of progression through the university semesters, usually in the first year of study or with students enrolled on access or foundation courses. Other research has shown that the ABC Scale is useful for gauging the impact of learning development initiatives or interventions on student engagement and achievement. Some significant projects have used the ABC Scale to contribute to developing theories about student-teaching interactions and the learning-teaching interface with the intention of suggesting how these might be modified to enhance learning effectiveness at university with a view to raising academic attainment, or at the other end of the student-learning spectrum, to reduce attrition. Significantly, many studies have reported that academic confidence, as operationalized through academic behavioural confidence, may be related to academic achievement. It is of note that no published studies have been found which explore how specific learning difficulties such as dyslexia impact on academic confidence at university and hence there appears to be a gap in the research which this research seeks to fill.