

Educational Psychology

Cognition and Learning,
Individual Differences and Motivation



Jonathon E. Larson
Editor

NOVA

EDUCATIONAL PSYCHOLOGY: COGNITION AND LEARNING, INDIVIDUAL DIFFERENCES AND MOTIVATION

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JONATHON E. LARSON
EDITOR

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PREFACE

The field of educational psychology is primarily concerned with teaching and learning. Educational psychology has a long historical past and an extensive record of conducting empirical research into the teaching/learning process. Educational psychology has also been involved with the topics of motivation, intelligence, memory, cognition, intellectual development and evaluation and assessment. Over the past 50 years, educational psychology has been predominantly involved with the learning processes of the “ normal, average “ student. However, over the past 20 years, mainstreaming and later inclusion has presented an additional challenge for educational psychologists and classroom teachers. This new book presents leading research on cognition and learning, individual differences and motivation.

Chapter 1 - Dyslexics form one of the largest groups who encounter educational difficulties, especially in school with both academic and social curriculums. Such difficulties may affect their emotional well-being and result in numerous adverse coping strategies which may affect their ability to access the school curriculum.

This chapter investigates N=26 dyslexic teenagers from several perspectives: (1) Using a number of standardised measures (self-esteem, coping and depression) to assess how they cope with parents, peers and teachers; (2) Interviewing them about how they cope, looking at their strategies and reflecting on their relationships with parents, peers and teachers; (3) Analysis of the standardised measures to locate factors to explain how dyslexic teenagers cope; and (4) Investigating an experimental teenager screening measure which aims to allow parents to assess their dyslexic child's positive and negative coping strategies, as a reaction to school and their relationships with peers and teachers.

Resulting standardised measure data suggests: (1) There are significant gender differences in how males and females cope; (2) There are differences between task based coping and emotional coping amongst dyslexics; (3) Avoidance plays a part in coping strategies for all dyslexic teenagers; (4) Self-esteem rates vary according to the coping strategy chosen; and (5) Depression features in the coping of dyslexics, especially females.

Three factors were identified and named ‘Trying’, ‘Avoiding’ and ‘Feeling good’ from the standardised measures, using factor analysis and Pearson Correlations.

Resulting interview case studies suggest: (1) Avoidance is a key coping strategy; (2) There is apprehension about letting others know they are dyslexic; (3) Hobbies are vital for their self-esteem and motivation; (4) They excel in non-academic subjects; and (4) Their difficulties cause them stress and frustration.

Using responses from parents, the experimental parental measure was validated using correlations and factor analysis from the standardised measure. Thus parents were able to identify all three factors and a reduced N=21 parental measure was created from N=47 experimental items.

Combining all elements of the study:

- (1) Dyslexic teenagers use two types of coping, described as 'Trying' and Avoiding' with an independent self-esteem scale 'Feeling good', as found by standardised measures;
- (2) Parents were aware of their child's helplessness due to their dyslexia;
- (3) The experimental scale was successful but needs further development with other samples;
- (4) Depression and emotional coping features in the coping of dyslexics, especially females; and
- (5) Findings from the two interview studies indicate that avoidance is a key coping strategy.

Overall, profiles were produced which indicate that teenagers with dyslexia suffer emotionally at school from their hidden disability and this needs to be taken into account when managing them in the classroom.

Chapter 2 - The theoretical concepts of (situational and individual) interest and motivation are of central importance to educational psychologists, because they denote phenomena that are said to mediate cognition and learning, and therefore individual development. In general, interest and motivation are approached predominantly from individualist cognitive perspectives, as entities or processes said to be embodied in the individual mental structure. The method, however, is not without its critics. Thus, the existing approaches to motivation can be seen as tools in the hands of the ruling class and therefore, psychology as a servant to the interests of this class. Whereas scholars may not agree with such analyses, the cultural-historical and sociocultural origins in the work of the Russian social and educational psychologist Lev Semenovich Vygotsky point us to other possible problems with individualist approaches to motivation and interest. According to Vygotsky, all higher mental functions have their origin in inter-human societal relations. That is, therefore, rather than studying forever-inaccessible structures of minds for the situational and individual interests a person develops and their relation to a person's motivations, a sociocultural and cultural-historical approach begins with studying societal relations generally and societal relations in which interests and motivations are (a) the topic of talk or (b) resources in the pursuit of other topics. This, then, leads us to the approach taken in discursive psychology, a relatively new discipline that already has made substantial contributions to the study of cognition generally and to the study of knowing and learning more specifically. In this chapter, we draw on an empirical study of career interests and motivations of high school biology students who were given the opportunity to participate in internship experiences in a university science laboratory. The scientists had offered these opportunities for the express purpose of increasing enrollments in the university's science faculty. Here the authors outline and exemplify a discursive approach to studying interest and motivation, which is an important and necessary perspective because participation in any human activity is always mediated societally, culturally, and historically. They show how interest and motivation talk is produced and the intelligibility of such talk shared as cultural resource. The authors suggest

that a discursive approach has significant possibilities for educational psychology, because ontogenetically, the authors learn what interest and emotion are in and through participation with others in conversations about interests and motivations. Therefore, interest and motivation are phenomena that for any individual are brought about in social interactions and discourse situations rather than phenomena that can be theorized as having their independent origin *within* the individual human being. They conclude with recommendations for a discursive approach to the study of interest and motivation that parallels a similar approach we take to “purely cognitive issues” such as conceptions and conceptual change.

Chapter 3 - In this chapter the authors will engage in a theoretical quest for ways to ameliorate reading fluency in dyslexics. In the first section they will provide an overview of research on dyslexia and dyslexia treatment and we will discuss the limitations of traditional interventions to ameliorate the poor reading fluency of dyslexic children.

In the second section of the chapter the authors will have a closer look on reading fluency, often referred to as the ‘neglected’ aspect of reading. They will discuss the essential role of extensive reading experience in the development of reading fluency and focus on repeated reading, the most familiar and most researched approach to fluency training.

A state of the art overview of insights from cognitive neuroscience, concerning fluent and disrupted reading, will be given in the third section of the chapter. In this light we will discuss cognitive, neurobiological and connectionist models on reading development and additionally focus on other areas of skill learning, such as chess.

In the fourth section the authors will amalgamate the various insights, draw several conclusions regarding fluency-oriented instructional practices, and proposed some new directions for dyslexia treatment. Additionally, they will demonstrate the unique possibilities provided by edugames, or computer-game training, for the implementation of the proposed educational principles. As an example the authors will present an edugame, called LexyLink, which we developed in our own laboratory and which we are currently testing in our institute.

Chapter 4 - In many developing countries in Africa, learners’ cultural background seems to be one of the major factors that militate against their learning of formal science in schools. On many occasions, the stakeholders in education attribute poor performance in science to bad teaching, the difficulty and the abstractness of science. What they fail to address, however, are the circumstances of the learners, which are mainly cultural. The influence of culture on the learning of science in schools should be addressed seriously by teachers, parents and educational planners. Culture has the categories of beliefs, practices, behaviour, communication skills, values and attitudes. This chapter presents empirical studies on the influence of culture on the learning of science in primary and secondary schools in Kenya. The chapter is divided into three major sections. Section one examines the manifestations of cultural influence on the learning of primary science in schools in four cultural communities in Kenya, the Maasai and Kipsigis of the Rift Valley province, and the Abagusii and Luo of Nyanza province. Section two is about the influence of cultural beliefs in the form of metaphors concerning “heat” in form three students’ explanations of everyday life experiences in Nyandarua district. Section three examines the influence of the Bukusu culture of Bungoma district, on students’ conceptions of the topic “nutrition” in secondary school biology. The chapter concludes with a discussion on the challenges this poses to science education in Africa.

Chapter 5 - This chapter reports a study using non-linear dynamic and microdevelopmental approaches to modeling students’ conceptual change in science.

Cognitive processes of children's conceptual change in learning a scientific concept, i.e. magnetism, were intensively observed at an interval of minutes, and a mathematical model was then applied to fit the observed patterns. Based on the comparison between the three simulated trajectories and the three empirical trajectories, we identified a dynamic reciprocal interaction between the student's actual developmental level and the instructor-guided potential developmental level responsible for different microdevelopmental trajectories. It was also found that the dynamic interaction between the rate of cognitive growth and the difficulty of learning content explained the variability of individual students' learning trajectories. The research findings suggest that cognitive processes of conceptual change in science are a self-organizing system in which various trajectories of learning emerge through the interactions between student parameters (e.g., prior knowledge and rate of learning) and teacher parameters (e.g., instructional goals and pace of teaching).

Chapter 6 - This chapter will consider recent debates about educational psychology assessments. Although work in the UK will form the basis of the discussion, the arguments should be seen to be relevant to educational practices around the world and the evidence covered will be multinational. The discussion focuses on issues related to literacy development and the identification of literacy learning difficulties (dyslexia) and, therefore, the chapter will review the debate on the validity and reliability of IQ-achievement discrepancy criteria as a way of identifying specific literacy learning weaknesses and alternative positions arguing for practices that adopt narrow behaviourist models in terms of their theoretical explanations and educational input. Definitions of dyslexia that encompass all word level literacy weaknesses will also be covered and evidence will be presented for phonological skills being a key component to literacy development and for the power of instructional techniques in education. The chapter will consider cognitive assessment procedures that evaluate a range of skills (literacy, phonological processing, verbal and non-verbal reasoning, semantic, vocabulary and visuo-spatial skills) possessed by the individual and the potential advantages of such procedures for the identification of appropriate intervention strategies. This background will be used to propose that progress in the provision of a range of interventions that can be used effectively with all learners requires a recognition of the complementary nature of these views and argues for research to assess the efficacy of this complementary perspective. It will also be used to argue for the need for investigations that recognise the overlap and relationships between usual development and a spectrum of learning difficulties. The focus of the chapter is an appeal for the need to combine the roles of individual differences and instructional precision in education as well as research investigating the efficacy of using these perspectives in combination.

Chapter 7 - The Coping Inventory for Stressful Situations (CISS) (Endler & Parker, 1999) identifies three main behaviors in response to stress – trying hard to perform, blaming oneself or others for one's failure, and avoiding exposure altogether.

It has been shown that, amongst pupils with dyslexia, these three behaviors are associated with different genders (Alexander-Passe, 2004a, 2006, in press) and different levels of self-esteem and depression (Alexander-Passe, 2004a, 2006) – in particular:

- Trying hard to perform – mainly males, gaining academic self-esteem from teacher approval
- Avoiding exposure – mainly females, shielding overall self-esteem

- Blaming – mainly females, losing personal self-esteem and showing depression.

As it happens, these three behaviors are opposites to the three that make up the simplest possible, basic learning dialogue (Zimmer, 2001; Zimmer & Chapman, 2004; Zimmer, 2008):

- Listening receptively rather than blaming, so as to invite thinking
- Showing comprehension rather than just trying hard, so as to invite listening in return, and
- Sharing one's own thinking rather than avoiding exposure, so as to invite comprehension.

Evidence from the dyslexia literature shows that the three CISS behaviors are common amongst pupils with dyslexia, indicating that dyslexic pupils are often disengaged from the basic learning dialogue.

It was hypothesized that this non-engagement is due to teachers themselves not offering the basic learning dialogue.

Accordingly, the dyslexia literature was analyzed for reports of teachers' not offering receptive listening, or comprehension of pupils' thinking, or their own thinking in response.

Reports fitting this description were found in unfortunate abundance. In particular, teachers of dyslexic pupils were found often to impose:

- Rote teaching in place of their own thinking
- Judgmental discounting in place of receptive listening, and
- Humiliation for failure in place of comprehension.

It is concluded that learning by dyslexic pupils is at risk from teaching that does not support the basic learning dialogue.

An implication is that, for support of dyslexic pupils, care for the learning dialogue itself may be what matters most.

Chapter 8 - Cognitive load theory (hereafter CLT; see Sweller, 2006; Sweller, van Merriënboer & Paas, 1998; Sweller, 1994; 1988) has been used for nearly two decades to develop innovative learning formats in instructional design. It essentially draws upon some aspects of the information processing/schema theory approach to learning. The theory maintains that it is critical to take into account the limitations of our working memory if learning is to be efficient. Using hundreds of controlled empirical studies comparing conventional instructional formats to formats guided by CLT has generated positive results. These have been critically reviewed and generally accepted in the field of educational psychology.

The use of CLT designed formats suggest there is less mental effort for the learner, a reduced training time, higher performance on test scores and transfer to similar problems, and longer duration for retention of information. The theory presents one perspective of our cognitive architecture.

Among the many CLT instructional designs used, two concern individual differences and motivation. These are:

1. The prior knowledge of the learner (termed the expertise reversal effect - see Kalyuga, Ayres, Chandler & Sweller, 2003) and
2. Mental rehearsal (termed the imagination effect – see Ginns, 2005; Leahy & Sweller, 2007; 2005; 2004).

The expertise reversal effect is an interesting and counter intuitive effect explored by CLT where learners who have some prior knowledge of the instructional material may do worse, under certain conditions, rather than better than those learners with no prior knowledge.

The second condition, mental rehearsal, is a learning strategy that has been used for many years (e.g. Sackett, 1934; 1935). It has been known variously by other terminology including “anticipative reasoning” (Dunbar, 2000) and “self-explanation” (Renkl, 1997). Since 1998, CLT has researched this approach in a series of experiments and termed it the “imagination effect”. A number of motivational and cognitive issues have emerged that illustrate the conditions that make the strategy either viable or unproductive.

One of the relevant limitations of CLT is that the experiments do not cater *enough* for individual differences of the learner. Important factors within the field of individual differences such as motivation, learning styles or gender for example are not adequately taken into account.

This chapter will outline CLT, and then provide a summary of various experiments conducted within its theoretical framework. The experiments include exploration of the expertise reversal effect, the use of an imagination strategy (imagination effect) and unique work on CLT and motivation conducted by Pass, Tuovinen, van Merriënboer and Darabi (2005) and Pass and van Merriënboer (1993). From all of these studies, the chapter will identify some issues and limitations emerging concerning motivation and individual differences. New directions that may address these will be suggested.

Chapter 9 - Attitude towards school is an important predictor of academic well-being (McCoach, 2002; McCoach & Siegle, 2003; Patrick, Anderman, & Ryan, 2002). Furthermore, the underlining motivational and affective components and their relationship with academic achievement are not yet well established.

The present research aimed to explore the relationship between attitude towards school including the motivation and emotions connected to the academic setting, and achievement. The general hypothesis is that the attitude towards school mediates the effects of motivational and affective aspects on academic achievement.

To test this hypothesis the authors adopted two methods. First, they examined the structural relationships between attitude towards school, motivations, emotions and achievement. Second, the authors verified the efficacy of an educational training focused on motivation and emotions (Friso, Moè & Pazzaglia, 2004) in improving the attitude towards school. Results confirmed the mediating role of the attitude towards school in shaping the relationship between affective-motivational variables and academic achievement, but also showed a direct influence of self-confidence on school achievement. Educational implications are highlighted.

Chapter 10 - Behavioural adjustment problems in schools are becoming matters of increasing concern among professionals of education and psychology. Although it is well-known that adolescence is a period of particular risk for involvement in antisocial activities, there are still questions to be addressed if the authors are to understand the *whys* behind such

behaviours, and especially why this problem is present or is more serious in some adolescents than in others. There is now greater consensus among researchers regarding the role played by family in the origin and development of behavioural problems in children. Particular characteristics of the family environment, such as negative or avoidant communication between parents and children and the lack of parental support, have been highlighted in this context. However, an intrinsic feature of the adolescent period is its opening to new relations with significant others apart from parents, mainly peers and teachers, as well as to new social contexts such as the school.

In this communication the authors analyse the relevance of social life at school, school environment and school experience in adolescent behavioural adjustment. They particularly examine the link among social experience at school and other two factors that have caught the attention of researchers in the last two decades but that unfortunately have not been addressed in depth in the scientific literature: the authors are referring to attitude to formal authority and social reputation among peers. With attitude to authority we refer in the present communication to the attitude the adolescent holds towards the school as a formal institution and towards teachers as formal figures. Social reputation among peers makes reference to the social recognition on the part of others in the same classroom or school. Both factors, namely *attitude to school* and *reputation among peers* seem to be closely associated to antisocial behaviour among students and, from our point of view, both deserve more attention as well as a jointly consideration and analysis due, on the one hand, to their link and joint contribution to the explanation of certain risk behaviour that occur in schools and, on the other hand, to their important implications for the design of prevention and intervention programs at the school settings.

Chapter 11 - This chapter proposes a 'stipulative' definition of dyslexia, in which it is emphasises that the phenomena of dyslexia constitute a syndrome. Some of the main characteristics of the syndrome are then described. They include lateness in learning to read, poor spelling, slowness in appreciating the significance of symbolic material, and other manifestations which will be described below. The condition often runs in families. It is argued that if dyslexia is defined simply as 'poor reading' or 'reading disability' there is risk that the many other manifestations of the syndrome, including the positive talents of dyslexics, will be overlooked.

Chapter 1

**HOW DYSLEXIC TEENAGERS COPE AT SCHOOL:
COULD A NEW MEASURE BE HELPFUL IN
SCREENING THOSE IN DIFFICULTY?**

Neil Alexander-Passe

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ABSTRACT

Dyslexics form one of the largest groups who encounter educational difficulties, especially in school with both academic and social curriculums. Such difficulties may affect their emotional well-being and result in numerous adverse coping strategies which may affect their ability to access the school curriculum.

This chapter investigates N=26 dyslexic teenagers from several perspectives: (1) Using a number of standardised measures (self-esteem, coping and depression) to assess how they cope with parents, peers and teachers; (2) Interviewing them about how they cope, looking at their strategies and reflecting on their relationships with parents, peers and teachers; (3) Analysis of the standardised measures to locate factors to explain how dyslexic teenagers cope; and (4) Investigating an experimental teenager screening measure which aims to allow parents to assess their dyslexic child's positive and negative coping strategies, as a reaction to school and their relationships with peers and teachers.

Resulting standardised measure data suggests: (1) There are significant gender differences in how males and females cope; (2) There are differences between task based coping and emotional coping amongst dyslexics; (3) Avoidance plays a part in coping strategies for all dyslexic teenagers; (4) Self-esteem rates vary according to the coping strategy chosen; and (5) Depression features in the coping of dyslexics, especially females.

Three factors were identified and named 'Trying', 'Avoiding' and 'Feeling good' from the standardised measures, using factor analysis and Pearson Correlations.

Resulting interview case studies suggest: (1) Avoidance is a key coping strategy; (2) There is apprehension about letting others know they are dyslexic; (3) Hobbies are vital for their self-esteem and motivation; (4) They excel in non-academic subjects; and (4) Their difficulties cause them stress and frustration.

Using responses from parents, the experimental parental measure was validated using correlations and factor analysis from the standardised measure. Thus parents were able to identify all three factors and a reduced N=21 parental measure was created from N=47 experimental items.

Combining all elements of the study:

- (1) Dyslexic teenagers use two types of coping, described as 'Trying' and Avoiding' with an independent self-esteem scale 'Feeling good', as found by standardised measures;
- (2) Parents were aware of their child's helplessness due to their dyslexia;
- (3) The experimental scale was successful but needs further development with other samples;
- (4) Depression and emotional coping features in the coping of dyslexics, especially females; and
- (5) Findings from the two interview studies indicate that avoidance is a key coping strategy.

Overall, profiles were produced which indicate that teenagers with dyslexia suffer emotionally at school from their hidden disability and this needs to be taken into account when managing them in the classroom.

Keywords: Dyslexia, Teenagers, Coping, Stress, Avoidance, Withdrawing.

LITERATURE REVIEW

What Is Dyslexia?

Dyslexia is a widespread condition, with an estimated frequency of one dyslexic child in each mainstream school classroom (Miles, 1994). Professor Berlin of Stuttgart (1872) coined the term 'dyslexia', based on the case histories of adults who could read only three to five words, but were of high intelligence. Use of the term has continued to this day, with dyslexia likened to conditions with neurological abnormalities. Initially, it was thought to be purely an acquired condition from accidental brain damage, until Kussmaul (1878) found developmental cases of word blindness. Orton (1937) first noted the main aspects of developmental dyslexia as pronounced reversals (b/d, p/q, on/no and was/saw), orientation difficulties/strong left-handedness and conflicting lateral preference, which forms the basis for many definitions (see Thomson, 1996; Miles, 1994). This study uses the definition from the World Federation of Neurology (1968), which defines dyslexia as 'a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence and socio-cultural opportunity'.

In the UK and many countries in Europe, terms such as 'dyslexia' or 'Specific Learning Disabilities (SpLD)' are used, whilst worldwide and especially in the US, 'Learning Disabled (LD)' and 'Reading Difficulties (RD)' are commonly used terms. 'Dyslexia' and 'SpLD' are more specifically concerned with difficulties that affect most situations (not just reading, e.g., co-ordination and balance) with neurological and phonological epidemiology. Reviews on dyslexia can be found in Thomson (1995) and Miles (1994).

Dyslexia is a negative disorder that affects many life skills (reading, writing, arithmetic) as well as balance and co-ordination, with Miles (1994, p. 189) suggesting that dyslexics

show 'an unusual balance of skills'. Individuals with dyslexia can be affected emotionally by being unable to learn as well as their peers, commonly resulting in low self-image, low self-concept and even depression (Alexander-Passe 2004a, b, 2008a, b, c; Riddick, 1996; Edwards, 1994; Ryan, 1994). For more than a decade, research has been carried out to identify positive attributes of this disorder; these investigations began with biographical and neurological studies. West (1991) located famous and influential individuals who had school learning difficulties, yet had found alternative ways of learning and succeeding in life (e.g., Albert Einstein, Leonardo da Vinci), making correlations between these factors and dyslexia, and creativity. Thus, public perception of creativity amongst dyslexics has grown (e.g., 712,000 hits on Google). Since West, the use of famous names with dyslexia (e.g., Charles Schwab, Richard Branson, Tom Cruise, Richard Rogers and so on.) has become widespread (Being Dyslexic 2006; Roehampton University, 2006; British Dyslexia Association, 2006; British Broadcasting Corporation, 2004; International Dyslexia Association, 2006; General Communication Headquarters, 2006, McLoughlin, Fitzgibbon and Young, 1994) to illustrate the career heights that dyslexics can reach. However, this could be misleading and could give false hopes to parents, as a high proportion of dyslexics leave full-time education with few or no qualifications (Grant, 2001)

Neurological investigations started by Geschwind and Galaburda (1985) noting clinical and post-mortem studies indicated atypical symmetrical brains, suggesting dyslexics have larger right (visual processing) brains; however, this conclusion was based on a very small sample of brains. Galaburda (1989) also suggests an 'alternative wiring hypothesis' that some abilities may be strengthened at the expense of others in the re-organisation in the brains of dyslexics. The classic measurement of dyslexia uses the WISC-R (Wechsler, 1974) measures, and the ACID profile (Thomson, 1996) indicates dyslexics show superior performance, rather than verbal skills, in WISC-R subscales. Thus, investigations have since been made into the possibility of superior visual-spatial abilities amongst dyslexics, with many correlating such skills to creativity (Padgett and Steffert, 1999; Wolff and Lundberg, 2002).

Nicolson and Fawcett (1993) note that a skill that would take a normal child 400hrs to develop and learn would take a dyslexic child 20 times longer to achieve. It is interesting that Fawcett and Nicolson (1994, 1996) found in their studies that 17yr old dyslexics achieved no better performance in a range of literacy skills than their 8yr old controls (in tests of psychometric, phonological and working memory, balance, motor skills and speed of processing). Fawcett (1995, p. 27) gave an analogy of driving through a foreign country, one can do it but at the expense of constant vigilance and an unacceptable cost in resources. Thus dyslexics can go through mainstream schools without high literacy skills but the emotional cost can be unacceptably high.

Teachers and the School

When life goes wrong for a dyslexic at school, it has a knock-on affect to life after school, thus the influence of school is profound (Scott 2004, p. 53). At school there are two curriculums: academic and social, failure in either or both will have lifelong effect on the individual and their success, and can be powerful predictors of later outcomes as intelligence is commonly correlated to academic achievement (Sylva, 1994). Whether you choose to or not in the UK, children must legally attend school for at least ten years and parents are legally

required to send them to a recognised institution, whilst home-study is an alternative, it is not encouraged and difficult to gain formal approval for such a choice. Each year at school can be unpredictable and is highly complex for both parents and children e.g. homework, class timetables etc. Integration with others (teachers and peers) can be fraught with danger with bad/good experiences and friendships having lasting impressions.

Several commentators (Fawcett, 1995; Edwards, 1994; Riddick, 1996, Saunders, 1995) view schools as legalised abusive institutions, where children are kept against their will and subjected to the will of teachers. Whilst in the majority of cases children and parents are accepting of such a regime, it does not suit all children and parents, so many choose to transfer out their child's education to the private sector. However, in the private sector more abuse may exist to motivate pupils, with some private schools requiring parents to sign forms to permit caning and other forms of corporal punishment, in the name of school ethos and learning.

Scott (2004, p. 54) notes 'all dyslexic children – and this is not a loose phrase – experience some form of damage from school'. Like all children, some excel in the school environment and others do not. In the case of dyslexics, larger proportions do not excel, resulting in high levels of stress and anxiety. Dyslexics find school an unpredictable battleground in which they are unskilled to exist. Scott (2004, p. 55) notes that 'for the vast majority of dyslexic children and adults, school has been a place of psychological and often physical torture...School for them was destructive and humiliating, nasty, degrading experience, sometimes of raw brutality, of which modern society should be deeply ashamed [of]', comments that others echo (Fawcett, 1995; Edwards, 1994, Riddick, 1996).

Dyslexics fail at school in numerous ways: failure to make friends, failure in literacy, failure to be attractive (to their peers as friends and teachers as receptive to help) and failure to be normal.

As school promotes both a social and academic curriculum, failing to make friends and failure to gain literacy are two basic stepping stones needed for development. Due to their learning difficulties they do not come across to others as normal e.g. clumsy and not knowing their left and right which affects play with others.

At school, failure in literacy has huge knock-on effects for the whole academic curriculum and with all subjects. Failing to read and write is a very public failure (Scott, 2004) and begins to propagate the idea that dyslexics are abnormal. This sets off a chain reaction that puts the child in a defensive state of mind and makes them fearful of all learning situations. School becomes a dangerous place and sticking out in class continues to the playground where teasing begins and can lead to unhealthy bullying. Children are very quick to pick-up who is the brightest and dumbest in the class and until a dyslexia diagnosis is made, the child begins to self-doubt and believe they are stupid, thinking 'if everyone says I'm slow/stupid I must be'. Lastly, teachers prefer easy children, children who do not create problems for them, as this confirms their effectiveness as teachers

Congdon (1995, p. 91) notes the reactions to failure at school 'can vary. Some children lose interest and adopt negative and avoidance attitudes. Others may try harder, spurred on by their teacher and parents, only to discover that the greater effort does not produce the longed for results'. Feelings of disillusionment and mystification sets in, as up to this point the child may have been told he was clever by his parents which he believed until now, thus he is now confused and develops self-doubts.

Teacher's Denial of Dyslexia and Teacher Training

Riddick (1996, p. 202) suggests whilst 'dyslexia is physically visible you have to know what it is before you can clearly see it. This explains why it is possible for teachers to claim that they have been teaching for thirty years without coming across a child with dyslexia. As they know nothing about dyslexia they never see a child with dyslexia'. Supporting such a view is Burden (2005, p. 42) noting the typical experiences of children in mainstream schools, with one boy as remarked by his tutor, '[he] said I was nowhere near dyslexic, I was just dumb. So we had about 10 more tests and everyone else said I was dumb. Then I went up to the dyslexia [institute] place in Bristol and they said 'how can anybody miss it''. One could ask, is this teacher denial or just a lack of knowledge on the part of the teacher?

Teachers of varying ages and experiences teach in mainstream schools, due to when and where they were trained and their experiences of children of different abilities. Many young teachers see it as the role of the Special Educational Needs Co-ordinator (SENCO) as used in the UK, to screen, refer and teach children with learning difficulties and avoid dealing with them themselves. Until 2000 in the UK, teacher training made the study of dyslexia optional, resulting in teachers having little or no knowledge about dyslexia (e.g. key traits and the best teaching methods). Burden and Gwernan-Jones (2008) in a study of N=183 UK teacher training students found that only 41% felt confident to some degree to support a dyslexic child (only 17% had full confidence) and the researchers felt that further practical training is required in the teaching syllabus to gain the confidence required. Seeman (2002) found that UK teacher courses for Special Educational Needs still taught that dyslexics have low intelligence, did not cover behavioural problems as a reaction to dyslexia and were packaged together with lecturers brain damaged children. Even when taught, many teachers still deny the existence of dyslexia, preferring to label their dyslexic pupils as 'disruptive' or just 'dim' (Pumphrey and Reason, 1991). Riddick (1996) found that many teachers were 'mystified' by the symptoms of dyslexia and regretted (in hindsight) not doing enough for such pupils. Whilst Ryan (2004) suggest that it is difficult to see how hard a dyslexic child is working, so teachers commonly perceive dyslexics as 'lazy', with Burden (2005, p. 43) remarking that commonly dyslexic children are told by their teachers 'you're not trying hard enough'.

Fawcett (2005, p. 13) notes 'this failure to understand dyslexia is not the fault of the teacher, but can be attributed to failure to train teachers adequately in the recognition of dyslexia'. Of course some teachers are highly trained and have taken a personal interest in understanding such conditions, whilst others in spite of training in the warning signs, tend to underestimate the incidence of dyslexia and are unprepared to work with the problem if they ever come across it. Whilst there are many developmental disorders faced in mainstream schools (ADHD, autism etc), dyslexia is by far the most common in western countries (Fawcett, 1995; Jorm, Share, MacLean and Matthews 1986).

Saunders (1995, p. 101) notes that 'many untrained teachers continue to pound away with inappropriate' teaching methods and the dyslexic child has begun to experience what I term as academic abuse'. Edwards (1994) found high frequencies of academic abuse by teachers amongst her dyslexic sample, whilst such abuse is unjustifiable, it may come from their frustration at teaching children who are 'broken learning machines' (as suggested by Hales, 1994) and who makes them feel ineffective and useless as a teacher.

Miles & Varma (1995) suggests that dyslexia specialists frequently meet the objection that there is no space in an already crowded teacher-training syllabus to add anything further about dyslexia, thus they question the government's sense of priorities.

Osmond (1994, p. 1) indicates that teachers typically dismiss dyslexia early on 'it's far too early to tell. He's a good natured child, very willing and co-operative. We're sure he'll come on. Give him time'. Many parents listen to this and allow their children to waste many additional years of school and learn that failure at school is a way of life. However, Riddick (1996, p.70) suggests that the vast majority of parents in her study, knew at an early stage that something wasn't right with their child, however they were frequently dismissed by teachers as being over-protective and too biased to make such an opinion, noting 'I just knew something was wrong, but I didn't know what it was', however when faced by teachers who were believed to be the experts, commonly parents backed down to what they believed was superior knowledge.

Teacher's Expectations

Rosenthal and Jacobson (1973) suggests that teachers treat children expected to do well differently to those that are not. Their study advised teachers that two groups (of randomly chosen children) had high and low IQ. The results found that the randomly selected children (expected to succeed) grew significantly in IQ over the following 12 months, as teachers gave this group more positive attention. Hargreaves (1972) reviewing the results of Rosenthal and Jacobson (1973) suggested that teachers' expectations play a large part in how children gain success, even if it is based on inaccurate information. Of course the opposite must also be true, that children expected to fail, commonly do, a form of self-prophecy. Good and Brophy (1987) reviewing all the evidence at that time on teacher expectations concluded that teachers tended to consistently treat high and low perceived achieving pupils differently, with low perceived achieving students being: chosen less often to answer questions even when they volunteered to answer; given less time to answer questions; were seated further away from the teacher; and verbal feedback tended to be more harsh and critical than those perceived to be high achievers who were given more praise. Burns (1982) suggests to avoid this, teachers should: interact evenly with all pupils in their care; talk to them all; realistically praise all children; and match tasks to their individual abilities.

More importantly 'these expectations can determine the child's level of achievement by confining his learning opportunities to those available in a particular class' (Cohen & Manion, 1995, p. 268). Teachers' expectations of pupils can impact on whether they are placed in a high or low ability set, and thus pupils will achieve to the expectations of his class and peers. It was found that children placed in a low ability-grouped classroom are unlikely to reach their true potential, as the teacher doubt their potential and consequently their achievement and motivation will be affected.

Good & Brophy (1987) similarly suggest that self-fulfilling prophecies play a part in the interactions of teachers and children in the classroom. Cohen & Manion (1995) note that it is natural for teachers to form different attitudes and expectations of their pupils, but these need to be assessed routinely. If not, the child may get caught in a 'vicious circle of failure' (p. 269).

Teachers make snap judgements about the abilities of their pupils; in many cases as Hargreaves, Hester and Mellor (1975) and Cooper (1993) note these are made on the basis of feedback from other teachers and on the knowledge of the child's parents and siblings.

Scott (2004, p. 72) suggests that 'whilst school is the malign incubator of the dyslexic child's problems, it is the relationship with teachers and peers that provide the nourishment and oxygen for such problems. If a dyslexic child had a productive, warm and supportive

relationship with a teacher and was valued, played with...he would cope really quite well with his literacy problems. He would also avoid most of the worst long-term effects of his dyslexia...unfortunately; it is the norm that a dyslexic child has significant problems with both teachers and peers at school.

These problems, more so than his dyslexia, make him unhappy and store up relationship problems for the future. In fact, it is my [Scott's] position that it is the relationship problems associated with dyslexia – rather than the literacy problems – that cause most of the damage to his psychological functioning'.

It is the teacher that makes the difference between a dyslexic child that learns and enjoys school or one that hates each moment in school and is unhappy. Scott (2004) notes this is can be the difference between a life enjoyed and a life hated, and that dyslexics that succeed in life usually have one teacher which has made the most impact in their lives. She goes on to suggest that teachers are all powerful in four significant ways: the class; the expectation of hope; teaching as power; and the power of expectation.

Thomson (1995, p. 37) notes an informed teacher could mitigate the dyslexic's difficulties in many ways: placing him in the front row of the class; repeating instructions; buddying them up with another child who could prompt him where necessary; and give extra time without interruption from others to answer questions. But for this to happen the teacher must recognise the learning problem, which is subject to their initial and continual teacher training. Thomson also notes that 'even when the teacher is sympathetic and helpful, the dyslexic child may be humiliated by the modified programme devised for him' depending on how it is presented to his class peers (p. 37)

Van den Oord and Rispen (1999) found the psychosocial adjustment of children was more affected by the structure of the class, under the direct control of one teacher, than the ethos of the whole school. Teachers regulate the rules, strictness, conveys praise and criticism and favouritism for a class of young minds, more so in the primary school as one teacher teaches most if not all subjects for that academic year. de Pear (1997, p. 19) found that most children expressed a strong need to be accepted and to gain positive attention from their teacher, even more remarkably, this was despite 'few had experienced any real feeling of being seen as competent and responsible by their teacher'. Some and hopefully a small minority of teachers are attracted to the power involved in teaching a group of children. This power can be highly dangerous to the child with learning difficulties, as the teacher's power to ridicule is immense and can mean that the child's peers carry this to the playground in the form of bullying. This maybe explained by research suggesting that 75% of teachers were bullied when they were at school (Tattum, 1993); they might feel the need to carry on such pain. Teachers can give children either the expectation of hope or the expectation of failure, with high expectations leading to high achievement and self-esteem according to Burns (1986).

Scott (2004), Seeman (2002) and Riddick (1996) found some teachers were known to humiliate dyslexics on a daily basis, sometimes unconsciously, by making them read out loud in class, putting them on slow tables, giving them inappropriate books for their age (whilst it may be appropriate for their reading age) and sometimes just drawing attention to their inadequacies. Osmond (1994, p. 25) exemplifies this with one dyslexic child's experience 'Paul was almost ten years old when I found him crying over a spelling list. He explained that words seemed to move around when he tried to read, that he couldn't copy anything because

he was unable to retain the order of the letters in his mind, and that he was being told to look up spellings in the dictionary but found it impossible’.

Stanovich (1986) and Burden (2005) point to the knock-on effect that learning difficulties at school with gaining literacy/numeracy has. They call it the ‘Matthew Effect’ for the biblical quote ‘to those who hath shall be given; from those who hath not shall be taken away’. They note that ‘early difficulties at school in establishing the basic skills of literacy and/or numeracy are likely to have a cumulative effect in making it extremely difficult for such children to ever catch up (Stanovich, 1986).

Dyslexic children can be problematic in class, as they are unable to remember tasks and become very needy in large mainstream classes, the lack of progress in class can make teachers feel failure and they therefore distance themselves from more failure. Teacher’s lack of training in identifying a reason for the child’s failure is unhelpful and it is much easier to label children lazy and immature than to get to the bottom of any learning problem.

From the moment the dyslexic child enters school, they often are a puzzle to their teachers. Whilst they show high intelligence orally they have problems showing such intelligence when reading or transferring ideas to paper. As teachers hold literacy in such high esteem they begin to reduce their expectations of such children due to their failure in these basic building blocks of learning. Thomson (1995, p. 41) notes the reduction of expectations means the dyslexic child is not stretched and that low expectations can lead to low performance. Yet as Thomson notes, these children know they are not lazy or unintelligent, with the resulting performance at high contrast to their potential which can lead to stress. Their parents are also puzzled which can lead to stress from parents that believe that either their child is lazy or not working hard enough. Comparison to non-dyslexic siblings can increase the stress as such comparison is unfair and unproductive. It only reinforces the concept that they are different and a ‘broken learning machine’ (Hales, 1994). Thus stress can come from teachers, peers, parents and siblings.

Edwards (1994, p. 125) notes ‘many teachers and parents will be shocked, as I was, by the severity, extent and multiplicity of unpleasant experiences which [dyslexic] pupils in my study had undergone. One obviously did not expect pupils with literacy problems to describe their past school lives in glowing terms, but the skeletons which emerged from the school cupboards of childhood memory were indeed grim and frequently similar across the group’.

Perceptions of Normal

All children when entering school or nursery perceive themselves as normal. They have had many years of encouragement by parents from activities on a one to one basis, on entering school they begin to compare themselves to others as others compare themselves to them. They enter school thinking the world is a happy place and very quickly learn that there are winners and losers in life, children who can do things and children who can’t. Life changes from a safe and friendly environment to one that they must be on edge to defend themselves not only in the classroom, but in the playground as well. In primary and early secondary school, all children wish to be the same and not stick out, as experienced dyslexia teachers noted ‘dyslexic children – all children – hate to fail, hate to be different, hate to be singled out as having ‘special needs’ (Burden, 2005).

The undiagnosed dyslexic child sticks out easily as different and their segregation to the slow table or the remedial class does not help the situation. As the world of comparison has put them on edge, due to failure they become hypersensitive to criticism which is perceived to

be a logical reaction to frequent failure, more frequent than their peers (as found by Edwards, 1994 and Riddick, 1996). Cutting and Dunn (2002, p. 856) found that generally 'five year olds...were sensitive to criticism; they reacted significantly more negatively in response to criticised failure than in response to non-criticised failure'. Such a reaction causes the production of anxiety and lower self-esteem, indicating how fast school failure affects children.

Erikson (1959) notes that our early childhood experiences play a significant part in our attitudes towards ourselves and our place in the world. This shaping is called self-concept and is easily damaged. Rogers (1959, p. 138) discusses self-concept to be 'composed of such elements of the perceptions of one's characteristics and abilities: the perceptions and concepts of the self in relation to others and to the environments; the value qualities which are perceived as associated with experiences and objects; and the goals and ideas which are perceived as having positive or negative valence'. Or as Burns suggests (1982, p. 7) 'self-concept is best regarded as a dynamic complex of attitudes held towards themselves by each person' and has two parts: self-image and self-evaluation. However, Hansford and Hattie (1982) point out that self-concept, self-image and self-esteem are often used interchangeably without adequate definitions and applied without valid and reliable measurement techniques. This comes in part from the hypothesis that self-concept is based on a highly subjective set of constructed attributes and feelings which take on meaning for the individual through evaluation compared to their particular society (Burns, 1982), as also found with self-efficacy.

Morgan and Klein (2001, p. 53) suggests that dyslexics have strong awareness in comparing themselves with their peers and recognise intuitively their undefined and unacknowledged learning difficulties, with many adults noting that they felt this way from an early age. Gilroy (1995, p. 66) notes in her experience that dyslexic students tend to compare themselves unfavourably with their peer group and that Griffiths (1975) found that dyslexic students saw themselves as less intelligent than their peers. Thus they recognise their abnormality, as also seen by Alexander-Passe (2008b) with dyslexic adults.

Identification of Dyslexia/Special Educational Needs (SEN)

Bentote (2001) investigated UK's Hampshire Local Education Authority's screening and intervention for dyslexia, which followed 360 infant and primary schools over a three-year period and screened children in their first term of school with three different methodologies. These were: Dyslexia Early Screening Test-DEST (Fawcett, Pickering and Nicolson, 1992), Cognitive Profiling System-CoPS1 (Singleton, 1995), and asking teachers which children they thought likely to experience literacy difficulties in the near future. In total, CoPS identified 15.7% of the at risk pupils, DEST identified 20.9% of pupils and teachers identified 37% of the pupils. Despite the teachers identifying more pupils, both the DEST and CoPS 'identified pupils that the teachers had not identified'. It was hoped by the local educational authority that the teachers could identify all 'at risk' pupils themselves without the need for any additional screening tool, but Bentote's study suggests otherwise. Arrangements for funding additional provision to meet children's SEN in the early years sector remain incoherent and piecemeal with the conclusion that the older a child is, the more likely he or she is to have a statement (Audit Commission, 2002a, b).

Special Schools or Integration into Mainstream Schools?

Scott (2004) supports the view that dyslexic children and other children with disabilities are best served by going to a specialist school, whether it is a boarding or day school. Thomson (1990) notes an increase of self-esteem, especially academic self-esteem from transfer from mainstream to a dyslexic specialist school, with Crozier, Rees, Morris-Beattie and Bellin (1999, p. 34) noting 'children with dyslexia in SpLD units develop more positive self-concepts and levels of self-esteem than those left in mainstream education'. Pumphrey and Reason (1991) suggesting that dyslexics in mainstream school are disadvantaged, with Riddick (1996, p. 150) echoing this, stating 'particularly in schools where dyslexia was not acknowledged, children could feel very isolated', the isolation theme also came out in her studies that there were positives to having a close friend who was dyslexic. Special schools or units have access to full-time specialist teachers, rather than the few hours of specialists support normally given under the terms of a 'statutory statement of special educational needs,' as termed in the UK to mean direct government funding for specialist support. In such special schools, there is less bullying as no one is deemed to be different or abnormal. Morgan and Klein (2001) suggests that dyslexics attending a specialist school for dyslexia may be able to overcome the feelings of isolation and sense of being different than children in mainstream school experience, however they note that most dyslexics could be happily integrated into mainstream school if appropriate support is given at an early stage of their school careers.

The Audit Commission (2002a, b) found that in the UK, many requests for specialist support are delayed until secondary school, thus too late to stop the initial difficulty spreading into other areas of the curriculum, and into the social arena.

Hales (1995, p. 183) notes one dyslexic boy's experiences 'I was sent to a [specialist] school...all geared up for dyslexics and to my amazement I found I was no idiot but top of the form in my first term. I was very happy there....they made me into a person again', however one could also conclude that special schools have a lower academic curriculum, this boy may have been bottom of the class in mainstream school but top in the specialist school, as expectations were much lower.

Anxiety

Grigorenko (2001), Hales (1994) and Scott (2004) suggest there is clear evidence that dyslexics suffer from anxiety disorders. In addition, Legrand, McGue and Iacono (1996) suggest that approximately 20% of all adolescents suffer from anxiety disorders which can exhibit itself in numerous ways: panic attacks; irritability; restlessness; poor concentration; incoherence in speaking; fear; and the inability to move. Physical features include: dizziness; faintness; sweating; tremor; tension in neck; chest or stomach pain; nausea; shortness of breath; diarrhoea; increased urination; palpitations; hyperventilation; and insomnia (Gomez, 1991). It has been linked with alcoholism and drug taking, with Scott (2004) suggesting that such abuse is higher amongst dyslexics than non-dyslexics.

As Gomez (1991, p. 68) states 'everyone is anxious some of the time - survival depends upon alertness to danger' and one should distinguish between rational human response to real threat, as opposed to the irrational, neurotic and often learned response of excessive anxiety that have become an end in itself. This is particularly relevant for dyslexics who may be

experiencing a very real threat to them[selves]' (Scott, 2004, p. 169). In studies of children's anxieties (Winkley, 1996; Jacobs, 1986) the following basic anxieties were found: fear of isolation; abandonment; not understanding; not knowing; being disoriented in new circumstances; and fear of the notion of emptiness. Scott (2004, p. 170) says 'I am struck by how almost every one of these childhood anxieties are particularized in the dyslexic condition'.

The DSM-IV (APA, 1994) defines excessive anxiety or phobia as when an individual's reactions are out of proportion to the demands of the situation, cannot be explained or reasoned away, is beyond voluntary control or lead to an avoidance of the feared situation. Other important signs are that such fears persist over an extended period of time and are unadaptive or are not age or stage-specific. Scott (2004, p. 170) a counsellor to dyslexics notes 'excessive anxiety occurs a lot in dyslexics, and it is a serious and disabling condition...anxiety often leads to panic attacks in both dyslexic children and adults'. Thus it could be suggested that dyslexia as a condition is disabling and the excessive anxiety resulting from the condition is also disabling, thus a double whammy!

Stress and Dyslexics

Stress is the personal perception of how one communicates with the environment around us and is highly subjective. It is normal for pupils to be anxious when taking tests as people commonly wish to do their best. According to Thomson (1995, p. 33), 'stress appears threatening only when it becomes pervasive and invasive, when it affects too many areas of our lives and when we have neither the strategies nor the energy to cope with it'.

A combination of factors (e.g. lack of strategies or lack of skills) can result in: 'an overwhelming sense of apprehension, incompetence and confusion, sleeplessness and fatigue. It also invites the victim to resort to escape mechanisms which indirectly relieve pressure, to fantasise, obsess, rebel or withdraw' in dyslexics at school (Thomson, 1995, p. 33).

Whilst one can't reasonably protect children from all stress, as some measure of it is useful, parents and teachers should monitor stress levels carefully. Thomson (1995, p. 34) notes that 'if stress levels become intolerably high, many dyslexic children develop their own inappropriate strategies, becoming disruptive, aggressive, withdrawn or school phobic'. Some even also enter primary school vulnerable, as they have already learnt in pre-school that are unable to learn as easily as their peers.

As Fawcett (1995, p. 12) notes 'it is hardly surprising that life is stressful for a dyslexic child who is failing within the school system....a useful analogy here might be that of the dyslexic constantly running on a treadmill, just to stay in one place in a range of skills that others acquire with ease'.

Hales (1994) notes using the 16PF (Cattell, Eber and Tatsuoka, 1970) with 300 dyslexics of mixed age, found that infant aged dyslexic children had scores which indicated that they were tense and frustrated, the primary school, low motivation and high anxiety and at secondary school a desire to keep in the background. Also in the middle school he found there was a noticeable drop in confidence and optimism, especially among girls. He also found an overall inverse relationship between anxiety and IQ, with middle school children with low IQ have the higher levels of anxiety.

Alexander-Passe (2008c) investigated the sources and manifestations of stress in school-aged dyslexics compared to sibling controls. Results suggest significant differences between the groups, with dyslexics in primary school experiencing the highest stress levels,

specifically in interactions with teachers, worries over academic examinations (SATs) and performance testing, causing emotional (fear, shyness and loneliness) and physiological (nausea, tremors, or rapid heart beat) manifestations. Results also suggest that dyslexics in larger families (3 to 4 sibling families) experience greater stress in interactions with their peers, than those in smaller families (2 sibling families) – possibly from greater unfair sibling comparison.

How Dyslexics Cope

When dyslexics enter school, they enter a world where their abilities and strengths are different from those around them. What may be easy to their peers is very difficult or impossible for them. Thus when they recognise this difference, stress begins. Thomson (1996) isolated two types of reactions to stress at school in dyslexics. Firstly, ‘under’-reactions, where the dyslexic withdraws and manifests extreme anxiety, e.g. trembling and sweating when asked to read. These dyslexics have low self-opinions of themselves and generalize every aspect of their life as a failure. Secondly, these individuals have ‘over’-reactions to stress, e.g. being seen as successful in other areas, being the class clown, hiding their failure under a ‘couldn’t care less’ attitude and manifesting silly behaviour. This can also lead to aggression, with extreme cases leading to delinquency.

Self-Esteem

Morgan’s (1997) study of delinquent/criminal dyslexics found that, when dyslexic children fail to keep up at school, their self-esteem drops as they begin to question their academic abilities (developing inferiority complexes). There are suggestions that both unrecognised and recognised dyslexics receiving insufficient or inappropriate support can feel devalued at school and turn to deviant behaviour. This is a response to their sense of low self-esteem induced by school and as a way of gaining recognition from their peers (Kirk & Reid, 2001 & Scott, 2004). Riddick, Sterling, Farmer and Morgan (1999) and Peer & Reid (2001, p. 5) suggests ‘frustration leads very often to antisocial or deviant behaviour’ amongst dyslexics, especially those with low self-esteem.

Some pupils might disrupt a class because they interpret the class work as threatening, and use attention seeking to protect self-esteem, according to Molnar and Lindquist (1989). They suggest that if the teacher, in class with pupils, can help re-interpret the nature and purpose of class work (keeping the child’s self-esteem), the child’s long-term behaviour will change. But most teachers, as Molnar and Lindquist found, hand out reprimands, as this is the only skill teachers know to quickly influence a child’s present behaviour – a fire-fighting technique. Low self-esteem will also mean the development of a poor or negative self-image. Such beliefs can become self-fulfilling prophecy of expecting to fail (Riddick, 1996). Morgan and Klein (2001) note that childhood experiences of being labelled ‘thick’ and public humiliation caused by failing often results in choices which reinforce low self-esteem.

Studies of dyslexics suggest that low or poor self-esteem is commonly encountered (Hales, 1994, Riddick, 1996; Humphrey, 2002; Alexander-Passe, 2004a, b, 2008a, b). As Barret and Jones (1996) note ‘it would be naive to assume that dyslexics would have good self-esteem given their learning difficulties’ As dyslexics are often bullied, there are strong correlations between bullying and poor self-esteem, with particular strong relationships in

children with special educational needs (O'Moore and Hillery, 1992, p. 64). Specialist schools for dyslexics have been found to improve self-esteem, especially social and academic self-esteem (Thomson and Hartley, 1980), and Scott (2004) suggests the best improvements in self-esteem comes from literacy and the improvement of literacy breaks the difference between them and their peers, as 'difference' is the core of the problem.

Empirical studies note correlations between low self-esteem/anxiety and academic failure (Burns, 1979), more so with dyslexics, as Humphrey and Mullins (2002, p. 199) notes 'the experience of dyslexics at school has clear and demonstrable negative effects on the self-concept and self-esteem of children'. Riddick et al. (1999, p. 241) indicated 'the powerful mediating effect of literacy performance on how individuals perceive themselves and are perceived by others', suggesting literacy failure can distort the dyslexic's self-perception. As Thomson and Hartley (1980) and Humphrey and Mullins (2002) note, dyslexics acquire a belief that being a good reader is significantly correlated with both happiness and intelligence, with the implication that as they are not good readers they are unhappy and unintelligent. Which leads dyslexics to believe they are out of control in their own learning and destiny, which Burns (1982) found to be the single biggest factor a child needs to progress at school (above that of good teachers, facilities and curriculum). The lack of control can be seen as a predictor of academic success, with striking parallels found between learned helplessness and children with reading difficulties (Butkowsky and Willows, 1980, p. 410) with Hiebert, Winograd and Danner (1984, p. 1139) finding that dyslexic children 'attribute[d] their success to factors beyond their control'. Pumfrey and Reason (1991) also suggest that there are many correlations between learned helplessness and how dyslexics cope at school.

Gilroy (1995, p. 66) notes 'it is obvious that past experiences [of failure] leave a deep scar and that many [adult] dyslexic students have a poor self-concept and suffer from low self-esteem. Gilroy also details an interesting observation that in a spontaneous, undirected, general conversation lasting 20 minutes between five adult dyslexic students, the following words and phases were observed: hopeless at (seven times); useless at (five times); could never (three times); mess (twice); typical me (twice); never been any good at (twice). She points to 'typical' and 'never' suggesting deep-rooted poor self-image stretching back to childhood. Post-observation conversation noted four out of the five students 'often felt that they were thick'.

The failing reader must deal with self doubt which becomes far from being a secret shame, often becomes a public failure (Gaines, 1989). Osmond (1994, p. 31) found one boy saying 'I know inside I'm not stupid, but I look stupid to everyone else because all the things that I can't do are the things that you have to do at school'. Another young adult dyslexic noted 'the last person to be convinced I was dyslexic was me. I just thought I was thick at school and that it was my fault. I can remember the anger and frustration I felt, especially earlier on, and I still do I suppose, though not as much. I just felt uptight all the time'. This person had grown up thinking he was thick and stupid!

Riddick (1996, p. 32) notes one mother about her dyslexic son 'it was traumatic for him, incredibly traumatic, every morning I had to pull him up screaming 'I don't want to go to school' and then I had to pull him all the way down to school'. Riddick (1996) indicates there is general empirical consensus that children with reading difficulties are more likely to have behavioural and emotional difficulties (Tansley & Panckhurst, 1981; Gentile & Macmillan, 1987; Hinshaw, 1992).

Brinckerhoff, Shaw & McGuire (1993) identified the lack of positive self-concept as being the one consistent counselling issue that presents itself in people with learning difficulties, with Morgan & Klein (2001) suggesting this is the case amongst dyslexics. Battle (1992) claims that once an individual's level of self-esteem is well established, it becomes difficult to alter and remains relatively stable over time.

Dyslexic children with high self-esteem display more confidence and will volunteer answers or try out new subjects/tasks than lower self-esteem children. These high self-esteem children expect to succeed and attribute success to their skill/ability, according to Riddick et al (1999) and Burden (2005). Coopersmith (1967) also found that dyslexic teenagers with high self-esteem were usually more successful in both academic and social environments compared to teenagers with low self-esteem. Wszeborowska-Lipinska (1997) investigated successful dyslexics who reached university education in Poland. To reach this level, she found that successful dyslexics had higher self-esteem than their peers.

Coping (Task/Emotional/Avoidance)

In the study of coping, Endler & Parker (1999) suggests that three areas (Task, Emotion & Avoidance) should be investigated, as each play a part in coping methodology:

Task-Based Coping

Coopersmith (1967) found that successful dyslexic teenagers were active, expressive individuals. Wszeborowska-Lipinska (1997) investigated successful dyslexics and found that successful dyslexics were pro-active to overcoming hurdles, which required high levels of self-confidence. Scott et al.'s (1992) study found key factors to success amongst dyslexics to be: encouragement of talents; hobbies (from peers etc); and a search for self-worth. Reiff, Gerber and Ginsberg (1997) study of successful individuals with learning disability (an American term for dyslexia) also found that persistence and stubbornness were assets. McLoughlin et al. (2002) found hard work and determination to be underlying factors in success at school. All these traits: expressive; pro-active; search for self-worth; persistence; stubbornness; and determination are descriptions of task based coping strategies.

Emotional-Based Coping

Trying hard or asking for help and not receiving any, can cause children enormous frustration (Edwards, 1994). Parents and teachers see bright and enthusiastic children who are not successfully learning to read and write. Ryan (1994) comments that no one knows how hard the dyslexic is really trying, and each year that their peers surpass them in reading skills, their frustration increases.

It is important for teachers to recognise the frustration that dyslexics feel at school in the classroom: an inability to express their ideas in written form; an inability to read books of interest (rather than for their reading age) and having to work considerably harder than their peers to attain the same achievement level (Thomson, 1996). The negative experiences of school, as found by dyslexic teenagers in Edwards (1994) had associated reactions of lack of confidence, self-doubt/denigration, and sensitivity to criticism, behavioural problems, truancy/school refusal and competitiveness disorders.

In Butkowsky and Willows' study (1980), average to good readers attributed their success to their ability, whilst poor readers attributed their lack of success to luck. Poor readers however tended to blame themselves by attributing failure to their own incompetence,

and success to environmental factors e.g. luck. Correlations to 'learnt helplessness' (Burden, 2005; Diener and Dweck, 1978; Miller and Norman, 1978) can also be made.

Dyslexics often react to their difficulties by withdrawing emotionally, or conversely becoming aggressive, compensating.... by obtaining negative attention from others (Thomson & Hartley, 1980, p. 19). Supporting Butkowsky and Willows, Hales (1995) suggest there is strong evidence to imply that dyslexics are more disturbed by criticism. Hales found dyslexics experienced considerable amounts of criticism at school, especially before their condition was diagnosed.

All these traits: frustration; lack of confidence; self-doubt; sensitivity to criticism; behavioural problems; competitiveness disorders; self-blame; and aggressiveness are all descriptions of emotion based coping strategies.

Avoidance-Based Coping

In large schools, avoidance of competing or reaching potential goes unnoticed, compared to smaller schools. This extreme non-participation through lack of confidence is a recurring characteristic in dyslexics (Scott, 2004). Avoidance strategies deflect attention from low academic ability and under-performance and teachers see these avoidance strategies very differently, with perceptions such as laziness and lack of parental support.

Edwards (1994, p. 61) also noticed that some dyslexics suffer from competitiveness disorders, with many withdrawing both academically and socially 'Gareth only tries hard if he thinks he can win. If not he merely gives up.... Nevertheless, he had to be very sure of his good standard before making himself vulnerable again'.

Anxiety causes humans to avoid whatever frightens them, and dyslexia is no exception. However Ryan (1994) notes that teachers misinterpret this avoidance as laziness. In fact he notes that the avoidance is more related to anxiety and confusion than apathy. Reid (1988) found when pupils feel 'unwanted, rejected, uncared for and disillusioned ... they start to manifest their disaffection by staying away, disrupting lessons, or underachieving'.

If academic success cannot give dyslexics self-worth, then they begin to withdraw from classroom activities (negative environments), according to Morgan (1997). There is a growing body of evidence to suggest that children with dyslexia avoid tasks which highlight their difficulties. Avoidance techniques can be as simple as constantly breaking the tips of pencils, so as to spend maximum time sharpening them and consequently less time at the desk doing work, although dyslexics (especially females) tend to prefer less obtrusive ways to avoid academic work, by rarely putting up their hands or sitting at the back of classes to be invisible (i.e. not picked by teachers to take part in the class).

Riddick (1996, p. 131) suggests 'by secondary age all dyslexic children claim that they avoid difficult to spell words and over half of them claim that they put off or avoid doing writing'. In a study of dyslexic school children (primary and secondary), Riddick (1996, p. 130) found pupils commenting that they 'daily avoided using difficult words to spell, wrote less (avoiding making mistakes) and put off starting work as coping strategies'.

In fact, out of 45 noted strategies found by Riddick, avoidance was featured in 35 of them. The other 10 were characterised by asking classmates to help. These findings were similar to Mosely's (1989) study concerning adults and children with general spelling difficulties. Pollock and Waller (1994) found that dyslexic children were perceived as immature (in their vocabulary choice and mode of expression) by school teachers and examination board markers, as they preferred using words they knew how to spell. But, if

they did use words where the spelling is uncertain, they were accused of being careless and risking lower self-esteem. Thus word avoidance has attractive advantages to young dyslexics – they think it is better to be seen as immature than to risk embarrassment.

Another aspect of school refusal is shown by those individuals who develop psychosomatic disorders or other illnesses to avoid school: ‘I used to pretend I was sick, make myself puke, and say I don’t wanna go today’, one dyslexic teenager commented (Edwards, 1994, p. 110). Edwards gives an powerful example of psychosomatic pain in the following story of a 12-year-old dyslexic, Trevor developed a pain in his right leg requiring crutches. To him it felt like a rare disease. The hospital doctor concluded that he was dyslexic but intelligent, was therefore frustrated, and that the frustration was expressed as pain in the right thigh, which occurred about once every six months and could last 10 days at a time. Strangely enough, she found this same teenager was reluctant to be truant, as he felt there would be ‘repercussions and (that it) was pointless anyway’ (p. 39).

This suggests a main difference between normal truants and dyslexics avoiding school (social conscience). Another 12-year-old used to get into fights with larger or other (dyslexic) kids to get off school. The injuries were for mutual avoidance reasons, not anger, and usually meant two to three days off school.

Depression

Riddick (1996) found dyslexic primary and secondary school children reported themselves as disappointed, frustrated, ashamed, fed up, sad, depressed, angry and embarrassed by their dyslexic difficulties. Depression is a frequent complication in dyslexia, according to Ryan (1994), Burden (2005) and Scott (2004), although these were based on educated guesses rather than from any specific study or use of standardised measures. Although most dyslexics are not clinically depressed, children with this type of learning difficulty are at a higher risk of intense emotional feelings of pain and sorrow. Evidence suggests that dyslexics commonly manifest low self-esteem, explaining why many dyslexics (especially female) internalise such sorrow and pain. Depression in school-aged children may be manifested by their being more active in order to cover up painful feelings (extrovert) or their being loath to enjoy anything from their day (introvert). Both types will manifest negative thoughts about themselves and see the world in a very negative way.

A qualitative study by Alexander-Passe (2008b) researched adult dyslexics (N=7) with a clinical depression diagnosis, the study investigated the emotional damage caused by coping with a learning disability such as dyslexia. Whilst the study investigated adult dyslexics with in-depth interviews, it was clear that the seeds of their depression came from childhood or from their teenage years. The overriding theme of this study was that the stress of both the academic and social curriculum of school can drive some dyslexics to depression and in some cases self-harm and attempted suicide. He notes, ‘in every interview one sees that either cries for help have been ignored or that the participants have not had anyone to confide in. Depression only happens after a large number of strategies have failed to produce the help needed and is either a last desperate cry for help or a total rejection of the help offered and they conclude that ridding society of their problems would be the best for everyone concerned (suicide attempt)’ (p. tba). All of those taking part were identified as adults and thus to a greater or lesser extent they had experienced childhoods of thinking they were stupid and suffered at the hands of numerous teachers they had passed through. ‘It was really surprising that apparently none of the ten or fifteen teachers they would have had and formed close

relationships throughout their childhood, never realised the child in their care had problems learning and attempted to ensure that something was done (e.g. diagnosis)' (p. tba). This can serve to illustrate problems in the mainstream educational system for this to have happened. The total breakdown of help experienced by the participants of the study, along with parents lack of faith in their own knowledge that their child had problems, was felt by Alexander-Passe to need to be highlighted. 'Camouflage, denial and perfectionism were found to help participants deal with present day life and such rewriting of their childhoods correlate with the defence mechanisms and strategies' (p. tba) this was also found by Vaillant (1977).

The study suggested that the secondary manifestations of dealing with dyslexia may be a significant factor for why some individuals develop depression and others do not. The study identified gender differences, suggesting that depressive female dyslexics felt isolated by their peer group, withdraw and self-blame, whilst depressive male dyslexics used denial and helplessness. In both genders, avoidance of words, tasks and situations were commonplace and any failure could bring back childhood memories of 'I'm stupid and unworthy'. 'Returning to school later to meet their own child's teachers was found to be fraught with danger as the smell and layout of the building made childhood feelings resurface resulting in many avoiding such situations' (p. tba).

Defence Mechanisms

In a study by Alexander-Passe (2008c), he investigated the use of defensive mechanisms in dyslexics. He hypothesised that 'dyslexics are a unique population with an emotional or behavioural split in their mechanisms. The framework suggests that early identification is the key to helping dyslexics choose mechanisms which will aid further learning. Where early identification was not made, dyslexics fail in more tasks than they succeed in and thus learning becomes a fearful activity and word avoidance is first used to reduce their failure rate. Where basic word avoidance alone is ineffective and parents are unhelpful in their approach to their child's difficulties, the child may choose either emotional or behavioural defence mechanisms. In the extreme these may lead to depression, suicide and crime, but it is hoped that only a small percentage are pushed to such a degree in dealing with life as a dyslexic. All Defence mechanisms were seen as cries for help and if their cries were unheard, then they moved from mature, to immature to extreme mechanisms to deal with stressful situations presented to them. Situations requiring basic literacy may not be seen as stressful to many (e.g. completing a form, remembering a telephone number or reading a newspaper) but to those with dyslexic difficulties, they are significant challenges which most people in society can handle with ease' (p. tba).

The hypothetical model suggesting how dyslexics cope by using defence mechanisms was based on the work by Vaillant (1977, 1992) and Meissner (1980), but evolved with a pre-defence of word avoidance and defences separated into emotional and behaviour defences, as supported by evidence from both empirical evidence and the three studies included in Alexander-Passe (2008b, c). Such a framework it is hoped will aid educationalists, psychologists and counsellors in understanding what defences are used and why, along with noting that all are cries for help from a learning difficulty that has life long effects.

The model suggests that teachers and parents should be aware that if children fail in more tasks than they experience success in, then they will find learning fearful and develop defensive mechanisms. Early identification is vital in young learners and will make a huge difference not only to their academic results but their self-esteem and self-concept as well.

LITERATURE REVIEW – CONCLUSIONS

The literature review begun by explaining what dyslexia is, when it was first identified and highlights several developments which have taken place over the last century. Whilst Thomson (1995) and Miles (1994) and others can be used to review the theoretical arguments (identification and remediation) for the different types of dyslexia (e.g. Visual, Surface, Phonological etc), there are few empirical reviews of the emotional effects of having such a disability and how it has affected both the self-perception and the emotional wellbeing of those that suffer an invisible learning disability. As Hales (1995) notes if dyslexics had a physical disability they would gain many more allowances in school from both teachers and peers. In dyslexics, individuals look ‘normal’ and thus are treated as such. When they are unable to achieve as their peers there is confusion and as found, such confusion is treated as a threat. Teachers perceive this as a threat to their abilities to teach. Peers perceive dyslexics to be abnormal and do not wish to be associated with them (as if they had a disease e.g. leprosy). In both cases the dyslexic child is rejected and isolated. In the classroom teachers give them less one-to-one time and are written off as un-teachable, in the playground they are the last to be picked for group activities as their performance is unpredictable, illogical and odd.

How many school-aged dyslexics cope with such rejection is to first isolate themselves from situations which have been proven to be problematic (e.g. social interactions), and secondly to avoid having their difficulties highlighted and thus avoid public humiliation of their inability to spell (e.g. so they avoid writing and especially using long words).

The empirical review found that many teachers think they know how to identify dyslexics, but research suggests otherwise. They base their notions of dyslexia on stereotypical cases of those who have all the classic symptoms (e.g. mirror writing, very clumsy, left & right difficulties) in very blatant manifestations. Empirical evidence suggests that no two dyslexics manifest the same collection of difficulties and that through years of mainstream education they have learnt several strategies to hide their dyslexia, thus they make the initial screening process even harder. Teacher training in the UK has only recently included mandatory workshops on dyslexia, however only in broad terms in workshops on the various types of special educational needs that are likely to be encountered in pupils in mainstream schools. Commentators question if this is adequate, however some training is better than none, which has been the case to date. The majority of teachers in today’s mainstream schools have little or no dyslexia training with little practical knowledge, and this has created a situation that dyslexics can easily slip through the system. Unfortunately in the UK a baseline program to assess all children at 4-5 yr olds when entering full time education has been diluted, resulting in an assessment over the first two years of school, which may not allow only two years of possible failure but teachers teaching a syllabus to pass such a test rather than allow failure to take place, such failure would be in the child’s best interest as it would allow support/monitoring to begin. However, it is not seen to be in school’s best interest to have pupils failing due to national league tables and additional strain on already stretched budgets.

The literature review has discussed the crucial role of teachers in the young dyslexic’s life, the relationship built up at such an important time can not be underestimated and can make the difference in a child growing up confident and successful and one that a lifetime of failure can be envisaged. All teachers make snap judgements concerning a pupil’s intellect

from small pieces of information, and use their years of experience to base their judgements on. Such judgements affect how they act and react to children in their care and should be recognised as important factor in how a child's school career will develop. If a dyslexic child is misunderstood and their attention-seeking is perceived as disruptive, they can easily be written off as problematic and denied the help/support they need. If on the other-hand their attention seeking is perceived as a cry for help, they are more likely to be helped and perceived as likely to respond positively to help in class. Both reactions by teachers will affect the self-concept of the dyslexic child and will in turn affect their use of strategies to cope with classroom situations. Trying, Emotion and Avoidance based coping have been identified in the literature and suggest that dyslexics will not always cope in the same way, (as each has a unique set of deficits), they will respond to the environment (teachers, peers, level of assistance) also in unique ways. Anxiety, depression and stress are just some of the variables which make teaching dyslexics a difficult task.

AIMS OF THE STUDY

This study will aim to try and understand the school-aged dyslexic and how they cope, not looking at specific strategies as these are normally personalised to the individual (e.g. mind-maps, note codes etc), but looking at overall strategies or types of mechanisms they use to deal with having an invisible disability: (1) A quantitative study will use a battery of measures to investigate how dyslexics cope, looking for trends to build profiles; (2) A qualitative (interview) study will aim to understand in their own words how they cope and specifics to coping with their invisible disability; lastly (3) An experimental quantitative measure for parents will be investigated, to find out if parents are able to identify their child's coping strategies.

SAMPLES

From the empirical review, the target group for the study was established as: late teenagers 15-17yrs olds (male & females), typically in their last year of GCSE or studying for 'A' levels. This group was chosen as most likely to understand their learning difficulties and to have the ability to respond to psychological and other measures. For Investigations One to Four, a sample was recruited from flyers included in dyslexia association newsletters, referrals from an educational psychologist and volunteers at one London 6th Form College. The project flyer requested dyslexic teenager and parent pairs to take part in a study investigating how dyslexic teenagers cope with school and home-life.

Volunteers were requested in four ways, see table 1. (The last three volunteer groups were recruited after the pilot study was completed). A flyer was designed with parents in mind, and packs of 20 of these flyers were sent to approximately 100 dyslexia associations in the UK, requesting inclusion in their next newsletter. Parent volunteers were requested to send a copy of their child's assessment (ideally by an educational psychologist using WISC-R) as proof of their child's dyslexia.

Referrals were made of dyslexics from a helpful educational psychologist, yielding N=25. It must be noted that these individuals did not initially request participation in the study and could be termed 'cold contacts'. Copies of names and addresses were initially released. The educational psychologist assessment reports, as proof of their dyslexia, were only released at a later date, when replies were received and participation and authorisation was confirmed.

Contact was made with the SENCO of a London 6th Form college. Likely dyslexic volunteers were asked in class if they would like to participate; all said yes. Test packs were coded and posted by the college for confidentiality reasons. Coded copies of their educational psychologist assessments, as proof of their dyslexia, were only released when test packs were finally returned; thus data protection was assured.

Out of the N=72 recruited from the flyers, all were chosen. Only N=26 (36% response rate) returned their packs, these included 17 males and 9 females. The sample included in these chapters are the culmination of both pilot and main study data, the volunteer prefix code (P or M) identifies whether there are pilot or main study volunteers. To take part in the study, the volunteer families needed to provide a copy of their child's educational psychologist report to confirm their dyslexia assessment.

For Investigation Five, contact was specifically made with three British dyslexia associations, two agreed to take part: Birmingham & Enfield. Each received 225 copies (450 in total) of the Parental Questionnaire and freepost reply envelopes for inclusion in their forthcoming newsletters. Three copies of the questionnaire were sent to each randomly selected address from their mailing, thus 75 families per dyslexia association. The request was made for school-aged dyslexics to participate in a study investigating coping.

Table 1. Samples recruited

Returns from dyslexia association flyer: N=22
Referrals from educational psychologist: N=25
Referrals from a London College: N=25
Returns from the Birmingham & Enfield Dyslexia Association mailing: N=35 (Dyslexic)

Problems Encountered with the Samples

Whilst dyslexia association newsletters were chosen as the main vehicle to gain volunteers for investigation five. Due to the high cost of dyslexia assessment by educational psychologists and the reluctance of Local Education Authorities to fund assessments, many or most of the viewers of the study flyer were unable to provide sufficient proof of their child's dyslexia in order to volunteer (as required and noted in the flyer information criteria).

Thus two types of families were found to volunteer: those who were able to afford a private educational assessment, and those who managed to push for a dyslexia assessment through their LEA. Both types could be categorised as committed parents (spending money or effort in order to know what was wrong with their child's educational development). Thus bias was found against uninformed (of their rights) and lower income families.

There were many different types of assessment used by educational psychologists, thus not enough educational psychologist reports of each profile (e.g. ACID) were gained to make comment to the sample's IQ.

There were also problems, gaining large enough samples to use high-level data mining analysis software.

Methodology

Volunteers for investigation one to four were sent a study pack which included: all the standardised measures used in this study; the experimental interview script and an audio tape to record replies; with a postage free (freepost) addressed reply envelope to return all the aspects of their participation. Postal questionnaires are known to have numerous problems of low return rates (United Bristol Healthcare 2003, Bradley et al 1996 & Cockburn 2003), so various methods were used to increase the return rates. Firstly, a freepost addressed reply envelope was included to increase the number of replies. Secondly, a chase card was sent six weeks following the initial posting, if no reply had been received by then. Thirdly, new copies of the battery of measure were sent four weeks after that to any still not returned, and a telephone call was also made to reconfirm participation in the study.

All measures chosen and created were designed to be easy to read and not over taxing for dyslexic teenagers and possibly dyslexic parents.

INVESTIGATION ONE – STANDARDISED MEASURES

The literature review highlighted certain emotional and behavioural aspects of how dyslexic/learning disabled school-aged pupil copes with school, especially self-esteem, avoidance and depression.

Three types of measures were regarded as required for further study in this area:

- A measure for Self-esteem: ideally looking at parental and academic forms of self-esteem.
- A measure for Avoidance: ideally to be compared with other types of coping, both positive & negative.
- A measure for Depression: ideally suitable for teenagers.

Three standardised measures were selected:

- CFSEI - The Culture-Free Self-Esteem Inventory (Form A) (Battle, 1992)
- CISS - The Coping Inventory for Stressful Situations (Adolescent version) (Endler & Parker, 1999)
- BDI-II - Beck Depression Inventory (Beck, Steer & Brown, 1996)

Methodology

CFSEI

The CFSEI was designed by James Battle (1992) to investigate four types of self-esteem (General, Social, Academic and Parental). According to Battle they are explained as:

- Social self-esteem refers to individuals' perceptions of the quality of their relationships with peers (i.e. self-esteem from friends)
- Academic self-esteem (i.e. school-related self-esteem) refers to individuals' perceptions of their ability to succeed academically (i.e. self-esteem from teachers and school)
- Parental self-esteem refers to individuals' perceptions of their status at home – including their subjective perceptions of how their parents or parent-surrogates view them (i.e. self-esteem from parents)
- General self-esteem refers to individuals' overall perceptions of their worth (i.e. self-esteem from themselves).

Factor Analysis and Validity and Gender Considerations

The 60 items of Form A were subjected to multiple factor analysis using a varimax rotation and then subjected to alpha (kr 20) analysis of internal consistency (N= 117 boys and girls in grades 7, 8 & 9). Alpha coefficients for the five factors were as follows: General .71; Social .66, Academic .67, Parents .76 and lie .70.

Content validity was built into the CFSEI by (a) developing a construct definition of self-esteem and (b) writing items intended to cover all areas of the construct. The construct definition as measured by the CFSEI is: self-esteem refers to the perception the individual possesses of his or her own worth. An individual's perception of self develops gradually and becomes more differentiated as he or she matures and interacts with significant others. Perception of self-worth, once established, tends to be fairly stable and resistant to change (Battle 1992). Battle (1992, 1981) found only insignificant gender differences.

CISS

The CISS was designed by Norman Endler and James Parker (1999) to investigate multidimensional coping. It investigates three main types of coping (Task-orientated, Emotion-orientated, and Avoidance-orientated). Distraction and Social diversion are included as sub-scales to Avoidance-orientated coping. According to Endler & Parker (1999), the scales are explained as:

- Task-orientated strategies are those that prioritise question information and analyse past-attempts to improve subsequent-attempts to deal with stressful situations or environments.
- Emotion-orientated strategies including internalising (e.g. drug abuse, alcoholism, psychic disorders or suicide) or externalising stressful (destructive acts against society) situations so that they blame themselves or others.
- Avoidance-orientated strategies include avoiding tasks by numerous different means (sometimes extremes): i.e. visiting friends rather than doing homework or gaining weight to avoid games.

- Distraction strategies include doing things to distract you from tasks e.g. not noticing errors to avoid making corrections [i.e. avoiding even noticing tasks].
- Social Diversion strategies include avoiding socialising to avoid having friends and avoiding situations where literacy will be tested e.g. paying by cash rather than writing cheques [i.e. withdrawing].

Factor Analysis and Gender & Validity Considerations

The data from N=313, 13-15yr olds (152 males & 161 females) and N=504, 16-18yr olds (270 males & 234 females) were subjected to multiple factor analysis using a varimax rotation and then subjected to alpha (kr 20) analysis of internal consistency. Alpha coefficients for the five factors were as follows: (13-15yr old males) Task .92; Emotion .82, Avoidance .85, Distraction .78 and Social diversion .79. In addition (13-15yr old males) Task .91; Emotion .90, Avoidance .83, Distraction .76 and Social diversion .84.

The construct validity for the adolescent form is supported by studies examining the CISS in relation to psychopathology, self-perception, and loneliness. The emotion-orientated coping is highly related to psychological distress, psychopathology, and somatisation. Task-orientated and avoidance-orientated coping, according to Endler & Parker (1999) are unrelated to these negative variables. The CISS was found to show significant gender differences.

BDI-II

The BDI-II was designed by Aaron Beck, Robert Steer and Gregory Brown (1996) and is the third generation of the BDI scale. In the last 35 years of its use, the BDI-II has become one of the most widely accepted instruments for assessing the severity of depression in diagnosed patients and for detecting possible depression in apparently normal populations (Archer, Maurish, Imhof, & Piotrowski, 1991; Piotrowski & Keller, 1992). The BDI-II investigates the following main factors to classify depression:

- Major affective disorders
- Depressive disorders, not otherwise specified
- Dysthymic disorders
- Adjustment disorders with depressed mood or mixed emotional features

Factor Analysis and Gender & Validity Considerations

The means, standard deviations, percentages symptomatic and correlated items for the outpatient and for the college samples (Beck et al, 1996) indicate significant differences; these would suggest the BDI-II differentiates between depressive and non-depressive groups. The factors of the BDI-II were subjected to multiple factor analysis using varimax rotation. Coefficients alpha for the outpatients sample .92 (N=500 mean age 37.20 yrs SD 15.91) and for the college student sample .93 (N=120 mean age 19.58 yrs SD 1.84). The mean coefficient alpha is .86 (Beck et al, 1996). The BDI-II was administered to outpatients (N=317 females & N=183 male); the authors found a mean difference with respect to sex (females: mean 23.61 SD=12.31 & males: mean 20.44 SD=13.28) [t (498)=2.29, p<.01]. With college students (N=67 female & N=53 male) there was also a significant mean difference with respect to sex (females: mean 14.55 SD=10.74 & males: 10.04 SD=8.23) [t (118)=2.53, p<.05] (Beck et al, 1996).

The BDI-II was developed for the assessment of symptoms corresponding to criteria for diagnosing depressive disorders listed in the Diagnostic and Statistical Manual of Mental Disorders-4th ED (DSM-IV) (American Psychiatric Association, 1994). Validity questions are resolved by its high correlation to the DSM-IV criteria. The BDI was found to show significant gender differences.

Why These Particular Tests?

The Culture Free Self-Esteem Inventory (CFSEI) has recently been used in a study of dyslexics and stress. Riddick et al (1999) used the CFSEI Mk2 test in conjunction with anxiety scales on 16 dyslexic adults (with controls). They found that the dyslexic group had significantly lower self-esteem than controls, although no significance was found with the anxiety scales. (The adult form of the CFSEI was used, so the data cannot be easily compared with the data from this study.) Thomson (1996) tested three groups of pupils at the East Court School and found over an 18-month period that the CFSEI was able to identify how pupils' social and academic self-esteem levels improved following specialist teaching methods designed for dyslexics. Burns (1986) has argued that there are clear links between children's self-concept and their academic performance, having found correlations between children with poor academic performance, low motivation and poor self-concept. As the designer of the CFSEI was a special needs teacher, the test was originally designed for use as a tool for children with special educational needs, such as dyslexics.

The Coping Inventory for Stressful Situations (CISS) has been used only once before with dyslexic samples. Hartley & Watkins (2001) used it to investigate stress and dyslexia in higher education. The study used an N=21 sample of dyslexic higher education students who were receiving support from the University of Liverpool's Student Support & Welfare Service. (There was an age matched non-dyslexic control group, N=19). Hartley & Watkins found higher levels of task-orientated coping amongst the dyslexics than amongst the non-dyslexics, but similar levels for emotional-orientated and avoidance-orientated coping. These results must be viewed in light of the biased sample, in that the dyslexics were receiving help from university support services and thus all were being taught coping strategies. The results suggest that dyslexics can be taught task-related coping strategies by (university) support service tutors, although emotional and avoidance defensive strategies were still prevalent amongst this group. (Avoidance was seen as a helpful strategy).

The Beck Depression Inventory (BDI-II) is well trusted for assessing depression, and both the CFSEI & the CISS have been correlated against it. Little is known about the depressing effects of being dyslexic at school as no study has actually investigated depression amongst dyslexics, especially amongst teenage dyslexics (except as anecdotes).

If the assumptions of other researchers (Ryan, 1994; Riddick, 1996) and of this project are correct, then a scale such as the BDI-II for measuring depression would be of use for defining the internalising of avoidance and other coping methods, as well as for assessing levels of self-esteem.

These Tests Have Been Used Together before

The CFSEI & the BDI-II have been investigated together (Battle, 1992) on a high school sample, grades 10-12 (N=26 with mean ages 16.0, N=15 males & N=11 females). High inverse correlations between self-esteem and depression were found, indicating that such variables are highly related among adolescents. Students with higher self-esteem (CFSEI)

scores tended to score lower on depression (BDI-II). The data suggests that depression in adolescents is associated with low self-esteem. The CFSEI and the BDI-II were also used to investigate an adult sample (N=43 males & N=86 females), where the correlation found between self-esteem and depression was -0.55 (males = -0.53, females = -0.56). Such data suggests that, when self-esteem increases; depression decreases and vice versa (Battle, 1992).

The CISS & the BDI-II have also been studied together with undergraduates (N=229 males & N=476 females) (Endler & Parker, 1999). Results indicate high correlations between the BDI depression scale and the CISS emotion scale for both males and females. There was a negative correlation between the BDI depression scale and the CISS task scale for both males and females. The two CISS avoidance sub scales (distraction & social diversion) were generally unrelated to the BDI-II depression scale.

Results

The Culture Free Self-Esteem Inventory-CFSEI

Analysis of the raw data results (see table 2) have been compared to both dyslexic and non-dyslexic samples. Whilst not ideal, as analysis of raw data doesn't take into account age or gender, but as many studies have analysed this way, it would be short-sighted to ignore such data. Analysis of the Total Self-esteem scores must be made in conjunction with table 3 as a guide. They indicate that the whole teenager dyslexic sample scored with low total self-esteem, however when the dyslexic teenager sample is split by gender, males scored in the low/intermediate range to females who scored in the very low range. As there are no norm studies concerning gender to compare the raw data of the CFSEI, no comment can be made but overall in the dyslexic teenager sample, females score lower than males in all sub scales of the CFSEI. Compared to the author's normative data (Non-Dyslexic Study 4 by Battle, 1992) this dyslexic sample has very low self-esteem and has lower self-esteem than the most depressed in the Social, Academic and Parental sub-scales of self-esteem.

Table 4 looks at the percentile data for the CFSEI, there is only one study which we show to compare with our school-aged dyslexics. The dyslexic teenager percentile data in this study, as indicated with the raw data indicates that overall they have lower than average self-esteem. Again we see gender differences with higher self-esteem in Males than Females, significantly shown in the General, Social and Academic sub scales. However such gender differences were not seen in the Parental sub scales and thus it could be hypothesised that whilst peers and teacher interactions are gender related, parental affects are less so, maybe parents are less gender biased than peers and teachers? Comparison to Dyslexic Study 2 (Thomson, 1996) suggest that this dyslexic teenage sample is indeed feeling bad about themselves and are similar to the 'initial interview' sample from Thomson, however not in the parental self-esteem. The exact same levels of parental self-esteem in the Thomson study suggests that from going to the interview for the private specialist school, the child knew that they were fully supported from their parents, which may not be present in the volunteers in this study.

Table 2. Culture Free Self-Esteem Inventory - Form A -raw mean scores (SD)

SAMPLE	Total SE	General SE	Social SE	Academic SE	Parental SE	Lie
TEEN DYSLEXICS (ALL) N=26	29.6 (11)	11.5 (5.2)	5.5 (3.1)	5.7 (2.6)	6 (3.1)	5.9 (3.1)
TEEN DYSLEXICS - MALES N=17	32.5 (11.4)	12.8 (8.9)	5.7 (3.4)	6.5 (2.3)	6.3 (3.2)	6.3 (3.3)
TEEN DYSLEXICS - FEMALES N=9	24.2 (8.5)	8.9 (4.7)	5 (2.6)	4.1 (2.5)	5.6 (2.9)	5.2 (2.9)
<i>Dyslexic Study 1 (Riddick, Sterling, Farmer & Morgan, 1999)</i>						
Dyslexic Adults N=16	19.76	10	6			5
Non-Dyslexic Adults N=16	25.95	14	7			7
<i>Non-Dyslexic Study 1 (Battle, 1992)</i>						
Successful N=97	36.44 (8.19)					
Unsuccessful N=90	30.23 (7.59)					
<i>Non-Dyslexic Study 2 (Battle, 1992)</i>						
Dysfunctional N=61	35.47 (9.07)	14.48 (3.60)	6.05 (2.42)	6.58 (2.55)	7.71 (2.48)	
Functional N=61	37.80 (7.92)	15.48 (3.14)	6.11 (2.390)	7.31 (2.42)	8.28 (1.77)	
<i>Non-Dyslexic Study 3 (Battle, 1992)</i>						
Least depressed N=not known	40.79 (5.45)	16.33 (3.03)	6.08 (1.45)	8.58 (1.118)	9.00 (1.44)	
Most depressed N=not known	27.48 (7.13)	10.48 (13.14)	4.24 (2.22)	6.32 (1.89)	6.84 (2.25)	
<i>Non-Dyslexic Study 4 (Battle, 1992)</i>						
Normative sample N=1679	37.98 (8.33)	15.87 (3.68)	7.29 (2.21)	6.97 (2.30)	7.88 (2.39)	

Table 3. Classification of CFSEI scores for the Total self-esteem sub scale

SCORE	CLASSIFICATION
47+	Very high
44-46	High
34-43	Intermediate
25-33	Low
24-	Very low

Table 4. Culture Free Self-Esteem Inventory - Form A - percentile mean scores (SD)

	General SE	Social SE	Academic SE	Parental SE
TEEN DYSLEXICS (ALL) N=26	25.4 (25.2)	34.3 (30.2)	33.1 (27.9)	34.9 (27.8)
TEEN DYSLEXICS - MALES N=17	28 (26.5)	37.2 (34.1)	37.6 (30.1)	35.5 (29.1)
TEEN DYSLEXICS - FEMALES N=9	20.2 (22.9)	28.3 (20.6)	24 (21.6)	33.7 (26.7)
<i>Dyslexic Study 2 (Thomson, 1996)</i>				
Initial interviewees N=15	50	32	45	87
After 6 months N=15	50	64	77	87
After 18 months N=15	60	84	77	87

The Coping Inventory for Stressful Situations-CISS

As with the CFSEI, several studies use raw data for their analysis rather than percentile data which take into account age and gender. Table 5 indicates the raw data and comparisons. The overall results for the dyslexic teenagers in this study suggest that compared to non-dyslexic study 5 (Endler and Parker, 1999) they score on par with norm data for psychiatric patients, but higher than the late adolescent norm data, and higher than the data from Dyslexic Study 3 (Hardley and Watkins, 2001). Dyslexia Study 3 should be taken in context, it investigated a dyslexic group of university students receiving specialised tuition. Thus the results in this study suggest that these teenagers scored better than dyslexic university students receiving help, whilst their study did not assess by gender, the dyslexic male teenagers in this study scored similar to the dyslexic university sample, with our dyslexic female teenagers scoring similar or higher than the control university student sample, suggesting that the university sample was likely to be mainly male and highlighting the long-term affects of having dyslexia. Introducing the gender breakdown data, there are significant difference with higher scores for females in all sub scales except for Task-orientated coping where comparable scores are seen. The non-dyslexic study 5 data includes gender break-downs, these suggest higher female scores for both early and late adolescent samples but not for psychiatric patients where males score higher in task-orientated coping, comparably in avoidance-orientated coping, distraction and social diversion and inferior to females in emotion-orientated coping. The gender data for the dyslexic teenagers in this study suggest no significant differences in task-orientated coping, but amongst the females higher use of emotion-orientated and avoidance-orientated coping with higher use of distraction and social diversion were found. Both distraction and social diversion differentiate between two forms of avoidance-orientated coping, in the case of our females they score in excess of psychiatric patient norm data and suggest that dyslexia as a variable uniquely affecting females.

Table 6 describes the percentile data for the CISS, taking into account of both age and gender. The overall results suggest that dyslexic teenagers in this study indicate average scores in all sub scales of coping as defined by norm data in Endler and Parker (1999). However, above average levels of task and emotion-orientated coping are indicated. According to this study's data, dyslexic teenagers tend to use slightly higher

than average task and emotion-orientated coping, average avoidance-orientated coping, and below average social diversion and low distraction.

The gender breakdown data suggests a different story, with significant differences in all sub scales except for task-orientated coping. The results suggest that dyslexic females use above average task-orientated and avoidance-orientated coping with distraction and social diversion, but higher use of emotion-orientated coping.

The Beck Depression Inventory-BDI-II

As BDI-II results are not converted into percentiles as a standard procedure, Table 7 indicates scoring ranges of depression from minimal to severe with no differences for variables such as gender or age. The data from this study has been compared to others and are detailed in table 8, however there are no known studies of dyslexics using the BDI-II. The overall score for this dyslexic teenager sample indicates a high minimal depression rating, which is comparable to individuals who are between non-depressed and mildly depressed from non-dyslexic study 7 (Beck et al., 1996) and normal college students from non-dyslexic study 6 (Beck et al., 1996). Data differences are present when breaking this study's data down by gender, with significant differences being indicated. Comparing the gender differences indicates females having a much higher score which is indicated to be a high mild depression score, indicative of those with adjustment disorders (according to non-dyslexic study 6), and closely related to mildly depressive scores as found in non-dyslexic study 7. The male data from this study sits comfortably amongst the normative non-depressed range.

Discussion

The results indicate that dyslexic teenagers in this study have self-esteem, coping and depression scores which are different to norm data and that gender is an important variable. The following are three profiles which are based on the data found. It must be noted that as there are only N=9 females in the whole N=26, the overall males scores dominate the overall profile.

Overall Profile

An overall profile of the dyslexic teenager in this study, based on percentile data suggest the above average use of both task-orientated coping (ability to prioritise questions and use past experiences to improve their coping) and emotion-orientated coping (either internalizing or externalising reactions of stress where they blame themselves or others) coping and average use of: avoidance-orientated coping (avoidance strategies to avoid work); distraction (doing things to distract themselves from seeing errors); and social diversion (avoiding situations which are stressful and threaten to highlight their difficulties) strategies to deal with their difficulties. Minimal depression is indicated which is amongst norm levels. Low: general (overall perceptions of self); social (perceptions of relationships with peers); academic (perception of their ability to succeed academically); and parental (perceptions of how their parents see their worth) self-esteem is indicated which suggest they have a low self-image of their abilities.

Table 5. Coping Inventory for Stressful Situations - raw mean scores (SD)

	Task	Emotion	Avoidance	Distraction	Social diversion
TEEN DYSLEXICS (ALL) N=26	53 (8.9)	48 (12.4)	48 (12.4)	21.7 (7.1)	17.8 (5)
TEEN DYSLEXICS - MALES N=17	53.4 (9.2)	44.5 (14.1)	43.9 (11.9)	20.2 (6.4)	15.8 (4.9)
TEEN DYSLEXICS - FEMALES N=9	52.4 (8.7)	55.1 (9.8)	54.8 (10.7)	24.2 (7.8)	21.2 (3.2)
<i>Dyslexic Study 3 (Hartley & Watkins, 2001)</i>					
Dyslexic students N=21	51.8 (11.2)	45.3 (13.3)	44.6 (10.9)	-	-
Self reported non dyslexics N=19	52.9 (9.1)	42.8 (10.7)	51.3 (9.8)	-	-
<i>Non-Dyslexic Study 5 (Endler & Parker, 1999)</i>					
Psychiatric patients (males N=164)	55.63 (13.70)	47.92 (11.84)	47.31 (12.19)	22.15 (6.76)	16.23 (5.17)
Psychiatric patients (females N=138)	50.75 (12.56)	52.62 (11.77)	46.33 (10.5)	21.33 (6.33)	16.72 (5.25)
Psychiatric patients (N=302)	53.19	50.27	46.82	21.74	16.475
Early adolescent (males N=152)	45.90 (12.97)	40.49 (9.76)	46.43 (11.73)	22.53 (6.47)	15.49 (4.99)
Early adolescent (females N=161)	48.85 (11.44)	46.55 (10.92)	50.72 (11.21)	15.83 (5.21)	18.37 (4.79)
Early adolescents (N=313)	47.375	43.52	48.575	19.18	16.93
Late adolescent (males N=270)	49.34 (11.06)	39.62 (11.93)	44.91 (10.98)	20.19 (6.04)	15.83 (5.21)
Late adolescent (females N=234)	49.56 (10.55)	48.38 (11.27)	49.41 (10.45)	21.96 (6.40)	18.14 (4.71)
Late adolescents (N=504)	49.45	44.0	47.16	21.075	16.985

Table 6. Coping Inventory for Stressful Situations - percentile mean scores (SD)

	Task	Emotion	Avoidance	Distraction	Social diversion
TEEN DYSLEXICS (ALL) N=26	60 (25.4)	64.5 (31.9)	53 (30.1)	48.1 (29.8)	52.8 (26.7)
TEEN DYSLEXICS - MALES N=17	61.2 (26.5)	61 (34.9)	47.7 (24.7)	41.1 (27.5)	45.9 (27.9)
TEEN DYSLEXICS - FEMALES N=9	57.7 (24.6)	71.6 (24.7)	63.6 (29.6)	60 (32.1)	66.6 (18.5)

Table 7. Depression scoring guide for the BDI-II

Range	Score
Minimal depression	0-13
Mild depression	14-19
Moderate depression	20-28
Severe depression	29-63

Table 8. Beck Depression Inventory – raw mean scores (SD)

	Raw Score
TEEN DYSLEXICS (ALL) N=26	12 (10.8)
TEEN DYSLEXICS - MALES N=17	9 (8.8)
TEEN DYSLEXICS - FEMALES N=9	17.2 (12.3)
<i>Non-Dyslexic Study 6 (Beck et al., 1996)</i>	
Hospital Outpatients (N=500)	22.46 (12.75)
College students (N=12)	12.56 (9.93)
Mood Disorders (N=264)	26.57 (12.15)
Major depression, single episode (N=62)	28.05 (11.75)
Major depression, recurrent (N=103)	29.45 (11.74)
Anxiety Disorders (N=88)	19.38 (11.46)
Adjustment Disorders (N=80)	17.29 (12.33)
<i>Non-Dyslexic Study 7 (Beck et al., 1996) n=127</i>	
Non-depressed	7.65 (5.9)
Mildly depressed	19.14 (5.7)
Moderately depressed	27.44 (10.0)
Severely depressed	32.96 (12.0)
<i>Non-Dyslexic Study 8 (Beck et al., 1996) n=620</i>	
Female College students	14.55 (10.74)
Male College students	10.04 (8.23)
Female Hospital Outpatients	23.61 (12.31)
Male Hospital Outpatients	20.44 (13.28)

Male Profile

The male profile is very similar to that indicated for the overall profile, due to their being a sample bias towards males, it suggests that they are coping quite well with being dyslexic, indicating above average task and emotion-orientated coping strategies; however they have a low opinion of their abilities, as indicated in their low self-esteem scores.

Female Profile

The greatest gender differences are indicated in creating the profile for female dyslexic teenagers. They indicate high use of emotional-orientated coping (either

internalizing or externalising reactions of stress where they blame themselves or others) followed by average use of avoidance-orientated coping (use of avoidance strategies to avoid work) and task-orientated coping (ability to prioritise questions and use past experiences to improve their coping). They also have high average use of social diversion (avoiding situations which are stressful and threaten to highlight their difficulties), and distraction (doing things to distract themselves from seeing errors) as strategies. From their use of emotional coping they score much higher than males in depression and this suggests adjustment disorders. Whilst they score low in parental self-esteem (perceptions of how their parents see their worth) as per males in study, they score much lower in: general (overall perceptions of self); social (perceptions of relationships with peers); and academic (perception of their ability to succeed academically) self-esteem which indicate significant differences to males.

Conclusions

The results from Investigation One suggest that dyslexic teenagers are an interesting sample group, with differentials to normative data. Gender was found to be an important variable in understanding the mechanics of the overall profile which has been over-dominated by the male profile. Female mean data suggests they predominately use emotional-orientated coping which is also confirmed in a higher depression rating, compared to males using a combination of both task and emotional-orientated coping which result in a minimal depression. Both males and females score similar levels of low self-esteem, but females score much lower in: general; social; and academic self-esteem sub scales. It is hoped that with the further investigations in Investigation Two, a better understanding of the data will be found.

INVESTIGATION TWO – QUALITATIVE INTERVIEWS

The empirical studies and Investigation One have highlighted that dyslexics and dyslexic teenagers cope in abnormal ways and are an interesting sample group. Investigation Two takes a qualitative look at the sample (N=18 out of N=26 took part in Investigation Two), with a structured interview using audio-interviewing methodology.

The study was specifically designed to ask questions about their school (difficulties & strategies), social life (friends and interactions with peers), family life (interactions with parents and siblings) and emotional stability (how having dyslexia affects them). These research areas were highlighted by the empirical review and were deemed to be worthy of further investigations. The items chosen (See Table 9) were based on previous empirical qualitative studies by Riddick (1996), Edwards (1995), Scott et al. (1992) and the personal experience of the author.

Methodology

This study will look at the qualitative data in two ways. Firstly as case studies to build up an individual picture of each volunteer by discussing:

- Their standardised scores as noted collectively in Investigation One.

- Descriptions of their difficulties due to their dyslexia.
- Descriptions of their strategies in dealing with their difficulties.
- Descriptions of how their difficulties affect them.
- Whether they had informed their teachers and friends of their dyslexia and reasons behind such decisions.
- Whether they have any dyslexic friends.
- Their hobbies and whether they excel in them to prop-up their flagging self-esteem/self-image.
- How their parents react to their dyslexia difficulties, and whether other members of their family are dyslexic.

Secondly, the data will be investigated to draw out quantitative elements concerning the four areas of study: school life, social life, family life and emotional stability.

Audio Interviews

In an Open University (OU) study of three data-recording methods (questionnaires, face-to-face interviews requiring note-taking and distance audio cassette interviews), Lockwood (1991) found little difference in the quality of data recorded between the three types of data-recording methods. Lockwood noted the following advantages of audio taped interviews: volunteers are willing to say more; they save time and costs; and they allow volunteers to decide the most convenient time for the activity. They also eliminate the possibility of the interviewer giving leading questions or non-verbal cues, or leaving questions open to interpretation – although this can be reduced in other ways, such as increased emphasis on questions and allowing volunteers to control the speed of their interview. The following disadvantages were also found: poor recording can detract from intelligibility; prevent opportunities for the volunteer to seek clarification of questions; and relinquish control of interview to the volunteer. A 53% response rate was noted with reasons for not returning tapes including health reasons and general apologies. Lockwood found volunteers only took a few minutes of recording to overcome initial fears about taping one's own voice. He notes that the interview script must be very clear, as any other clarification method would defeat the object of audio taping. In conclusion, the major strengths of this method are that it allows volunteers to choose the most convenient time for the task, and that it does not rely on the interviewer to set the pace. Another major advantage for this dyslexic sample is the reduced need for writing to answer the questions, an activity they find difficult.

Comparative Studies

Riddick's (1996) study of N=22 school-aged dyslexics investigated how they felt about their dyslexia and any difficulties encountered at school. The study contained both (N=10) primary school age and (N=12) secondary school age children and their mothers. The children and their mothers were interviewed separately. A semi-structured interview schedule was used, as this methodology is supported by Madge & Fassam (1982) as a valuable way to study the attitudes, experiences and needs of disabled children. Also in support of Riddick's methodology, Greenspan (1981) & Hodges (1993) both found that children and adolescents could be reliable subjects for self-report interviews. Validity was checked by triangulation between teachers, parents' and children's responses. Mothers were asked 36 questions and children were asked 28 questions. The questions covered home life, difficulties related to dyslexia, and support at home, school and at the Dyslexia Institute (a remedial organisation for dyslexics, with bases around the country staffed by

specialist tutors). Views on dyslexia and how they thought other children viewed their problems were also investigated. Where similar questions are used in both Riddick (1996) and this study, they will be highlighted and discussed.

The investigation by Scott et al. (1992) looked at N=14 successful adult dyslexics, defined by either academic success (graduates or upper level undergraduates) or career success (national and local leaders in television, broadcasting, dentistry, business, law and economics). The ages ranged from early 20's to early 50's, the majority being male with only three females. There were 24 questions requiring answers on a range of 'strongly agree' to 'strongly disagree'. In addition, there were 35 open-ended questions. Most interviews were conducted face-to-face with two conducted over the telephone. The questions investigated how the respondents felt about themselves, family and school life, and how they chose their careers. Where similar questions are used in both Scott et al. (1992) and this study, they will be highlighted and discussed.

Another relevant study is Alexander-Passe (2008b) who investigated a small group (N=7 with N=4 Males & N=3 females) with both a dyslexia and a clinical depression diagnosis. The study used a semi-structured interview methodology along with standardised measurement (quantitative) methodology. The study found that dyslexic participants were much happier taking part in the interview part than the form filling requirement of the study.

Procedure

As participants needed to read the interview script, short simple words were used to aid speedy comprehension, thus there was an awareness that some dyslexics may find complicated words hard to read.

The audio interview script was designed in reference to Riddick (1996) and Scott et al. (1992); to gain valuable information to supplement the other quantitative instruments used in this project. Questions were designed with the dyslexic teenager in mind, and were first piloted before being used for the larger main study.

In the pilot study, the interview script was printed on white paper. This was considered, from pilot study feedback to be harder to read by dyslexics (as also advised by a dyslexia specialist), so for the main study the interview script was printed on light blue paper, as certain coloured papers are easier for dyslexics to read. For both (pilot and main) samples, a freepost envelope was provided for easy, speedy and free replies.

The audio interview was sent by post (along with other measures) to the parents with an explanatory covering letter, asking them to make an appropriate audio tape recorder available for their teenage child (in order to tape their audio interview responses). A blank 90-minute audiotape was included for the audio interview. Transcripts of the audiotapes were made before analysis began.

From the final N=26 who returned the study packs (pilot and main study subjects), N=18 returned answers to the audio interview stage, with some participants omitting select parts of the audio interview which were later deemed by the author to be uncomfortable for volunteers to answer (e.g. how do you parents react to your dyslexia?). N=2 participants in the pilot and two in the main study replied by hand, rather than record their answers on to the audiotape. This may again be for reasons other than inaccessibility to a tape recording machine, as writing answers allows reflection and an opportunity to craft a defensive response (as also found by Alexander-Passe (2008b) with those who responded via email rather than through a telephone interview). Whilst the interview technique was aimed at removing the need to write answers and allow the interview to take place in the safe comfort of their home (using audio interview techniques), the

interview script was also designed to be non-threatening, however as Investigation One had highlighted, this dyslexic teenage sample had very low parental, social and academic self-esteem and thus as Alexander-Passe (2008a, b) has indicated, defensive mechanisms are commonly at play in defending the self-esteem and self-image of dyslexics.

Coding

The postcode of the participant was used for initial coding. When a transcript was made of their audio interview, a sample code was given e.g. P=Pilot & M=Main study, thus giving P01, P02 and M01, M02.

The Audio Interview Script

The following is the introduction (and script is contained in Table 9) that was used for the audio interviews:

- This part of the project requires you to answer a few questions and record your views on the audiotape enclosed. If you don't have a tape recorder, please ask your parents (or friend) if you can use their machine.
- When answering these questions please note that there are no right or wrong answers. I would just like you to tell me about your own unique way of coping with your dyslexia.
- Please repeat the question on the tape before answering it, so I know which question you are about to answer.
- Please take a moment to think about the questions and their answers before starting taping. Take as many breaks as needed but I would ask that the answers given should be your own, not your friends', siblings' or parents'.
- There is no time limit to each answer (except the length of the audio tape).
- PLEASE GIVE DETAILED ACCOUNTS/VIEWPOINTS

Table 9. Audio interview question script

Audio interview questions
(1a) What sort of work do you have difficulties with in school because of your dyslexia? E.g. maths and writing.
(2) What strategies do you use to try to deal with your dyslexia difficulties?
(3a) Do all your teachers and friends know you are dyslexic?
(3b) If not, why?
(4a) Do you think your parents understand what it is like to be dyslexic?
(4b) Is any other family member dyslexic as well?
(4c) Do you have any dyslexic friends?
(5a) What frustrates you the most about your dyslexia?
(5b) How do you deal with it?
(6a) Are you involved in any after school/weekend activities or hobbies?
(6b) Are you good at them?
(6c) Are you better than any of your (non-dyslexic) friends?
(7) Do you avoid any tasks e.g. spelling hard words, because of your dyslexia?
(8a) Does having dyslexia limit you in any way?
(8b) How do you feel about this?

Results - Case Studies

All names have been changed to retain the confidentiality and privacy of the teenage participants.

Harry (M04) is a year 10 teenage boy. His standardised scores suggest he has average social self-esteem, above average academic self-esteem and low general and parental self-esteem. He scores average in task-orientated coping and very low in emotional and avoidance-orientated coping with an insignificant depression score, likewise very low distraction and social diversion coping.

At school Harry has problems with recall of words, handwriting and spelling. His dyslexia frustrates him and he deals with his problems by substituting words which he can easily recall and spell, along with avoiding difficult to spell words and writing assignments which would highlight his difficulties, however he concedes that this means he gains lower marks with such a strategy. Harry has been proactive by telling all his teachers and friends he is dyslexic and is supported at home by a family with knowledge and experience of dyslexia – his brother; uncle and grandfather are also dyslexic. He excels in badminton compared to his peers.

Peter (M02) is a year 12 boy. His standardised scores suggest he has very low general, social and parental self-esteem; however he scores with very high academic self-esteem. He also scores with very high task and emotional-orientated coping with very low avoidance-orientated coping. Peter scores average in diversion and social distraction coping, with insignificant depression scores. At school he has difficulties with all subjects involving writing and spelling. Peter is irritated by his dyslexia and feels it holds him back as he relies on others to spell check his work. He deals with this by using a computer spell-checker and working where possible on the computer. He also consciously avoids school subjects involving writing and reading, which he feels has lessened his enjoyment of school as they are the subjects which he intellectually enjoys. His strategies includes making loads of notes, perseverance, using the computer and being highly organised. Peter has not been proactive in telling his teachers and friends he is dyslexic and feels he wishes to be judged on output rather than have feedback prejudiced by being known as having dyslexia. Whilst his uncle is dyslexic, he feels his parents don't fully understand how it affects him and he is frustrated by them telling him 'why can't you just use a dictionary'. Peter feels that time looking words up in dictionaries is a wasteful when he could spend the time more wisely on improving the content.

He enjoys creative writing but is unsure if he is better than his peers, even allowing for the use of a spell-checker.

Tami (M03) is a year 12 girl. Her standardised scores suggest she has very low general, social and parental self-esteem, with above average academic self-esteem. She scores extremely high in emotional-orientated coping with avoidance-orientated coping featuring highly, along with a severe depression score. There are average scores in task-orientated coping along with distraction and social diversion coping. She was only diagnosed last year, after extremely high examination grades in most subjects except for English language and literature. Her parents still question her dyslexia assessment as she is deemed to be very intelligent. Tami finds spellings and reading difficult and she says they fluctuate on a day to day basis and she therefore tends to avoid spelling difficult words. She deals with her dyslexia by perseverance and using a computer. All her teachers and friends are aware of her dyslexia and she has several dyslexic friends. Tami is involved in many hobbies and is very musical and sporty and feels that she is as good as her peers, however her musical abilities were held back by her inability to read music until she was 14yrs old. Her dyslexia frustrates her as she tends to be a perfectionist – her uncle is dyslexic however this doesn't seem to have helped her parents believe her dyslexia diagnosis.

Sophie (M01) is a year 11 girl. Her standardised scores suggest she has extremely low general, social and academic self-esteem, with low parental self-esteem. Sophie scores above average in emotional-orientated coping and high for social diversion, with a severe depression rating.

Other scores suggest very low task-orientated coping, avoidance and social diversion. She has difficulties with spelling and reading, causing her to feel frustrated and angry with herself (which is reflected in her high depression rating), as she feels dyslexia is limiting her in life. She also lacks coping strategies and will avoid activities if they will publicly highlight her difficulties. Whilst most of her friends and teachers know she is dyslexic, Sophie feels she gets little support, if any, in the classroom and she also lacks dyslexic friends. She uses sport as a means to deal with her difficulties/frustration and has very wide sporting abilities, from horse-riding, rugby, swimming to volleyball. She experiences success in sport and excels above her peers in such activities. Sophie feels her parents do not understand to how dyslexia affects her, however she gains some understanding and encouragement from her uncle and cousin who are dyslexic.

Anita (P01) is a year 11 girl. Her standardised scores suggest she has very low general, social, academic and parental self-esteem. She scores extremely high in avoidance-orientated coping and social diversion. She also scores high in emotion-orientated coping and distraction, a moderate depression rating and average in task-orientated coping. She has had problems with spelling, writing and mathematics, but has recently changed schools and has specialist dyslexia tuition which has re-taught her to read and spell; however she still has problems with mathematics. Anita's use of taught strategies and a laptop has helped. Whilst her teachers have been told she is dyslexic it doesn't seem to have helped her gain help in the classroom and they have needed constant reminders that she has difficulties. She is frustrated by her spelling ability and her inability to communicate clearly on paper, noting 'it sounds okay in my head, but when it comes out on paper it makes no sense'. Anita avoids spelling long words and is frustrated by the lack of extra time given in tests due to her dyslexia. She enjoys horse-riding and rides regularly. Whilst having no dyslexic friends, her father is dyslexic and her mother is supportive which helps her understand her difficulties.

Neil (P02) is a year 12 boy. His standardised scores suggest extremely low general, social, academic and parental self-esteem. He scores extremely high on emotion-orientated coping, above average task-orientated coping and average in avoidance-orientated coping, distraction and social diversion, with a minimal depression rating. Neil has in the past had problems with reading, writing and spelling, but due to extensive specialist dyslexia tuition over the last 4 years, he feels at present that these areas are not problematic, however he still has problems transferring ideas down onto paper and organisational problems. His strategies include using a computer to formulate ideas, dictating and redrafting with his mother and pressure from his parents to be more organised. He has told all his friends he is dyslexic and whilst his teachers have been told he is dyslexic, he notes they forget and need constant reminding which causes frustration in class related activities and homework. He gets angry at teachers who ignore the fact that his high accomplishments have come from many years of intensive tuition. He avoids using hard to spell words and puts off doing large writing assignments, which only adds to his disorganisation. Whilst Neil admits that dyslexia makes his life difficult, he is positive about the secondary benefits which include excelling in non-academic abilities (e.g. his singing in a band and playing musical instruments). Neil feels his mother understands his dyslexia due to her involvement in establishing a local parents group for dyslexics – his brother; father and uncles are also dyslexic.

Jordan (P03) is a year 12 boy. His standardised scores suggest extremely low general and social self-esteem, with low academic and parental self-esteem. Jordan scores extremely high on avoidance-orientated coping, above average in task-orientated coping and average in emotion-orientated coping, distraction and social diversion; with a mild depression rating. He has problems with essay writing, short-term memory and sequencing. He uses mind maps to remember equations, writing less and avoiding spelling hard words to cope with school demands. He feels most of his teachers and friends know he is dyslexic and has many dyslexic friends. Jordan gets frustrated and annoyed as he has difficulty putting his ideas down onto paper, he also feels dyslexia limits him educationally as he is unable to show his true ability. He excels in non-academic musical activities to a level beyond his peers, and feels understood at home, as both his father and sister are also dyslexic.

Andrea (P04) is a year 11 girl. Her standardised scores suggest extremely low general and parental self-esteem, with low social and academic self-esteem. She scores above average in emotion-orientated coping and distraction, average in task and avoidance-orientated coping and low in social diversion, with a minimal depression rating. Andrea has problems with writing, spelling and mathematics and uses planning, brainstorming, bullet points and extra preparation time as strategies, however she will write less and avoid spelling hard words. She is not proactive in telling her teachers and friends she is dyslexic with her noting that only one of her friends knows she is dyslexic and has difficulties at school. She gets frustrated by her difficulties and her inability to get the results she feels able to achieve. She excels in non-academic activities and feels she is better than her peers in these. Andrea feels she receives little support or understanding at home, even though another member of her family is also dyslexic.

Joshua (P05) is a year 11 boy. His standardised scores suggest extremely low general, social, academic and parental self-esteem scores. He scores extremely high on emotion-orientated coping and distraction, with average task and avoidance-orientated coping and social diversion scores, with a minimal depression rating. He experiences problems in English, mathematics, handwriting, memory and co-ordination. His strategies include being highly organised, writing less and avoiding spelling hard words. Joshua has been proactive by telling all his teachers and friends he is dyslexic; however he feels dyslexia has limited him in life, as he has difficulty with confusion and short-term memory difficulties e.g. remembering names and places, which have led to socialising difficulties. He has a few dyslexic friends but they are not close. Joshua excels in non-academic musical activities and has been chosen at national level for his musical abilities. He feels his parents try and understand his dyslexia and help where they can – he also has a brother with dyslexia.

Gabi (M18) is a year 12 girl. Her standardised scores suggest average general, social, academic and parental self-esteem. She scores average in task-orientated coping and social diversion, low in emotion-orientated coping and extremely low in avoidance-orientated coping and distraction, with a minimal depression rating. She has difficulties with maths, writing, grammar and spelling. Gabi's strategies include using a computer to draft essays, using a spell checker and others to check her work, avoiding spelling hard words and public writing tasks that would open her to ridicule in front of her peers. All her teachers and friends know she is dyslexic and she receives extra time in class. Whilst she does have dyslexic friends, they never talk about their difficulties, seeing it as an emotional support network, which might be the reason for her low avoidance and emotional scores and minimal depression rating. Gabi says that dyslexia limits her at school due to her terrible spelling and she gets very frustrated by her inability to express

herself on paper and her reliance on others to check her work. She excels beyond her peers in sports e.g. swimming. Her parents try to understand, help and support her difficulties, but as no one else in her family is dyslexic it is hard for them to fully comprehend how it affects her.

Gareth (M16) is a year 9 boy. His standardised scores suggest higher than average general and social self-esteem, with low academic and parental self-esteem. He scores above average in social diversion, average in avoidance-orientated coping and very low in task and emotion-orientated coping with a low distraction score. Gareth scores a minimal depression rating. Due to extra English and maths lessons, he currently only finds spelling difficult. Many years of extra private lessons have taught him strategies; however he still gets frustrated by his inability to spell words even when he can see what he is writing is wrong. He doesn't avoid writing and spelling tasks and is positive about his abilities at school. All Gareth's friends and teachers know he is dyslexic and he has a few dyslexic friends. He enjoys non-academic activities such as football and racing remote control cars and feels in these areas he is as good as his peers. Gareth feels his parents understand his difficulties; however no one else in his family is dyslexic.

Natasha (M14) is a year 12 girl. Her standardised scores suggest above average parental self-esteem, average general self-esteem, low social self-esteem and extremely low academic self-esteem. Her scores suggest that she scores above average in avoidance-orientated coping, distraction and social diversion. She also scores below average in task and emotion-orientated coping, with a minimal depression rating. She notes difficulties in maths, spelling, writing and understanding concepts. Natasha's strategies include: using a computer to draft essays and as a spell checker; asking her parents to check her work and spellings; and avoidance of hard to spell words and word tasks. Whilst Natasha doesn't feel dyslexia limits her in life, she does get frustrated by her reliance on others to check her work, Natasha commented that she gets 'night shivers' or panics when she works into the night to get her work done and there is no one around to help her spell a tricky word. Whilst Natasha's teachers know she is dyslexic, she sometimes avoids telling friends she has difficulties. Natasha has a number of dyslexic friends which she finds useful for support. Again we see how the support of others may explain why a low emotional coping score is seen along with a minimal depression rating. She feels her parents understand her difficulties, as she also has a dyslexic brother.

Zara (M12) is a year 12 girl. Her standardised scores suggest average academic self-esteem and low general, social and parental self-esteem. Her scores also suggest extremely high task-orientated, high emotion-orientated and avoidance-orientated coping, with high distraction but low social diversion. She scored a minimal depression rating. Zara's difficulties are concerned with expressing herself on paper and transferral of ideas clearly and effectively, her dyslexia affects her short-term memory recall, comprehension of information, punctuation and spelling. Her strategies include using more than one tutor to understand what tasks require, computer assistance, spider diagrams, highlighting key texts and bullet points to build essay structures. She will avoid complicated spellings and puts off checking work for punctuation, as she gets confused about sentence structure. Zara finds dyslexia limits her, as she has problems finding the right words to use and is unable to do note-taking quickly and gets frustrated at her inability to grasp the essence of what she has just read in a book. She also is annoyed and frustrated in her inability to do writing tasks which the rest of her family can do with ease and constantly relying on members of her family to spell check and explain her homework. Whilst most of her teachers know she is dyslexic, Zara has resisted telling all of her friends, as she fears they will make fun of her (e.g. has been called thick or dumb in the past) and is cautious of

letting new people know, even friends. She excels beyond her peers in art/design and is doing art courses at college, along with enjoying sporting and musical activities. Zara feels her parents and family don't understand her dyslexia, and make fun of her difficulties/reliance on them for help with homework. No one else in her family is dyslexic, however she has friends who are also dyslexic and this support network is helpful. Whilst the support of friends is helpful, we see that if this support is undermined from parents then it has little affect on the lowering of emotional and avoidance coping.

Izzy (M11) is a year 12 girl. Her standardised scores suggest she has average social self-esteem but very low general, academic and parental self-esteem. Her scores also suggest extremely high emotion-orientated and avoidance-orientated coping with distraction, along with high task-orientated coping and social diversion. Her depression score is moderate. Izzy felt unable to answer all the questions posed but from what was gained, she finds reading and comprehension of what she reads difficult. Also she is very shy and doesn't tell teachers and friends about her dyslexia difficulties as she finds it upsetting. Izzy feels her parents don't understand her difficulties and feels isolated by not having any friends or family members with dyslexia. She likens dyslexia to a disease 'no one in my family has it', which suggests a very negative perception of her difficulties.

Justin (M10) is a year 11 boy. His standardised scores suggest average general, social, academic and parental self-esteem. His scores also suggest high task-orientated and emotion-orientated coping with low avoidance-orientated coping, distraction and social diversion, with a minimal depression score. Justin notes his main difficulties are to do with English and languages, mainly essay writing, spelling and essay structure; however he has a poor short-term memory.

His strategies include using bullet points to build essay structure; repetition and he will consciously not avoid using difficult to spell words. He gets frustrated by his poor memory; however he is positive about the future and doesn't feel limited by his dyslexia. Justin has told most of his teachers and friends that he is dyslexic and sees dyslexia as a positive attribute. He excels in sport, especially rowing along with strategy computer games, and feels he is superior to his peers in both hobbies. Justin feels his parents understand his difficulties and support him, as his mother, sister and brother are also dyslexic.

Ronnie (M08) is a year 12 boy. His standardised scores suggest he has high parental self-esteem, low academic self-esteem and extremely low general and social self-esteem. His scores also suggest average distraction, below average task-orientated coping along with low emotion-orientated coping and very low use of avoidance-orientated coping and social diversion. His depression score is mild. Ronnie has difficulties with handwriting, spelling, organisation of ideas and comprehension of what is required by tasks. His strategies include: high use of repetition; using others to spell and grammar check his work; not consciously avoiding writing tasks or using long words. He gets frustrated when he spends huge amounts of time on homework and teachers read it and think it is nonsense, due to illegible handwriting and illogical sentence structure - thus the marks don't match the effort put in. Ronnie feels that dyslexia limits him as he is unable to get the results he would if allowed to answer orally. He is involved in extra-curriculum activities such as part of the debating team which he excels which is wholly oral - thus he feels able to compete fairly with his peers when there is no writing involved. Ronnie has quite a few dyslexic friends and feels his parents understand his difficulties, although no one else in his family is dyslexic.

Jonathan (M07) is a year 12 boy. His standardised scores suggest high academic self-esteem but low general, social and parental self-esteem. His scores also suggest very high

task-orientated and emotion-orientated coping with average avoidance-orientated coping and social diversion scores. He scores low on distraction and has a mild depression rating. Jonathan has difficulties with: making notes quickly and effectively; writing effectively; handwriting; and spelling. His strategies include going over what he wishes to say four of five times before committing to paper, also he spends a lot of time avoiding feared tasks e.g. avoiding note taking to pass onto others or submit for marking. He feels that dyslexia limits him in his ability to remember facts, names and details which his peers can do with ease, thus he feels disadvantaged and makes him feel frustrated, inadequate and useless (as seen in his high emotional scores and depression ratings). Most of his teachers and friends know he is dyslexic, but he feels that some teachers are only told if there is a problem, rather than for preventative measures. Jonathan is involved in musical and sport activities, especially biking and finds his dyslexia is advantageous in understanding and fixing bicycles - thus he is as good as or better than his peers in both activities. Jonathan feels he has support at home from his mother who works for special needs charities and from having several members of his family being dyslexic, including cousins and uncles.

Carole (M06) is a year 12 girl. Her standardised scores suggest average social and parental self-esteem but low general and academic self-esteem. Her scores also suggest high emotion-orientated coping with distraction and social diversion. Also manifesting average task-orientated and avoidance-orientated coping, with a moderate depression rating. Carole has difficulty with her short-term memory, spelling, reading, interpreting and remembering information from text books, the inability to filter out useless facts from useful facts in fast-paced lessons and making notes during fast paced lessons. Her strategies include using a highlighter, asking for help from teachers and parents, and avoiding spelling. She feels that her dyslexia limits her in life and hates the realisation that she is dependant on others so much. Carole is frustrated by her inability to do tasks that her peers find easy and her competitive streak makes her compare herself to others without dyslexia, which is unfair. All of her teachers know she is dyslexic and most of her friends are dyslexic. She interestingly notes that the only person in her study tutor group who isn't dyslexic, really sticks out. She excels in spoken languages, sport and art, with an appreciation that she is better than her peers in art. Carole feels her parents understand her difficulties, as her mother and siblings are dyslexic as well.

Results – Data Analysis

The interview script was designed to ask questions in four areas of the dyslexic teenagers life (school life, social life family life & emotional stability), these areas were found in the empirical review to be crucial aspects of how dyslexia affects individuals, especially those legally forced to attend mainstream education which can be inhospitable places for those with learning difficulties.

School Life

- The most (32 out of the 48 problems mentioned) common problems experienced by the sample were maths, writing, spelling and putting thoughts down on paper.
- Word avoidance is by far the most frequent coping strategy (N=15 out of N=19), followed by asking for help from others to spell-check work.
- The vast majority of the sample avoided spelling (N=15 out of N=19) and writing-related tasks, because of their dyslexia.
- More than half the sample felt that having dyslexia limited them in life.

- Only a small number (N=3 out of N=19) of participants asked for help in dealing with their difficulties. Although when frequently used it can be a crutch, if only occasionally used then it can be a catalyst to learning.

Social Life

- Only a third of the sample had large numbers of dyslexic friends. It was found that having dyslexic friends correlated with a lower emotional coping score and a lower depression rating.
- Most (N=15 out of N=19), if not all, of the sample's friends and teachers knew about their dyslexia.
- The vast majority excelled in their after-school activities/hobbies (N=16 out of N=19).
- More than half were better than their non-dyslexic friends/peers (N=12 out of N=19) in their chosen after-school activities/hobbies.
- After-school activities/hobbies featured highly amongst the sample, with either musical or sport-related being the most frequent.

Family Life

- More than half the sample thought their parents understood their dyslexia.
- More than half the sample had either dyslexic parents or siblings (N=12 out of N=19).

Emotional Stability

- Being dyslexic embarrassed a quarter of the sample.
- Most (N=15 out of N=19) of the sample could not cope with their dyslexia and saw it as just part of life, 'a burden to bear'.
- Most (N=14 out of N=19) of the sample were frustrated by their dyslexia, especially when it came to expressing themselves clearly to others in academic environments e.g. taking notes and reading aloud in class.
- The majority (N=16 out of N=19) of the sample had negative emotions about their dyslexia; these could have secondary behavioural manifestations.

Discussion

The audio interview data has been subjected to two forms of analysis (case study and quantitative assessment) and each work together to aid the understanding of this dyslexic teenager sample.

School Life

The resulting data from the audio-interviews suggests that the majority have difficulties at school due to their dyslexia, these problems were found to be related to organisational skills, short-term memory, reading and writing and in some cases mathematics. Their organisational skill problems mean that they have difficulty organising their time and prioritising homework. Short-term memory problems mean that their ability to retain the first part of instructions is lost by the time they digest the later aspects of instructions given orally (as commonly given to them in class). Nicolson, Fawcett & Dean (2001) suggest a 'square-root rule', if a simple task takes 4 sessions for a non-dyslexic to learn, then it will take 16 for a dyslexic. Thus, if a complex task took 400 sessions for a non-dyslexic, it would take 1600 sessions for a dyslexic. They note that

reading and writing effects the ability to interact with the whole school curriculum from science to art as writing skills are core to all mainstream subjects. The strategies found in this study seem piecemeal and seem to have little affect in their ability to feel good about their abilities, as noted in the case studies, with their self-esteem data. Avoidance of writing or situations requiring writing was a common feature and suggests as also noted by Riddick (1996) and Edwards (1995) that this strategy, be it a negative one, is commonplace and is key to reducing exposure to stressful situations. As Alexander-Passe (2008b, c) notes, avoidance is an integral part of 'Dyslexic Defence Mechanisms' and is the first step to more emotional or behavioural coping mechanisms. Interestingly the participants in this study felt that many of their teachers either forgot they were dyslexic or just used inappropriate teaching techniques which made their life at school difficult. Whilst it is deemed good practice for teachers to pass on vital information such as dyslexia to colleagues when children move year, commonly this does not happen and as found in this study teachers need reminding. When this happens parents contact the school but are seen as being pushy and any questioning of teachers abilities or methodology is taken badly, which makes the whole situation worse.

Social Life

Results from this study suggest that many dyslexics are isolated from others with similar difficulties and this has been found by other researchers (Riddick, 1996; Hales, 1995, Edwards, 1995) to be a cause of low self-esteem as many dyslexics feel that their difficulties are unique, that no one else has them (they are abnormal) and thus it is their fault. As all children and teenagers crave to be like their peers and belong, such feelings of being abnormal are emotionally charged and can not only make them isolate themselves from their peers (they might feel there is something wrong with them) or they are excluded by their peer group. This has been found by Edwards (1995), Alexander-Passe (2008a) and Riddick (1996), noting that peers called them 'spastic, weird, dumb, thickos' and other words which aim to label them as different and abnormal. This also meant that they were excluded from their peer group, both in the playground and socially outside school. The support network which comes from having other dyslexics as friends is important and can be vital to maintaining a high self-esteem, low emotional coping and a low depression rating along with a realistic self-concept. A child's self-concept is extremely fragile and perceptions of abnormality can cause untold damage (Scott, 2004).

Along with their ability to get on with their peers, comes the social networking from non-academic activities, ranging from music to sport. Results from this study suggest that dyslexics can not only excel in non-academic activities but commonly to the level to or beyond that of their peers. As noted earlier, Galaburda (1989) found that there are differences in the brains of dyslexics and these may allow compensational excellence in visual or other skills that do not rely on literacy, West (1994) notes that dyslexics who have excelled include: Leonardo da Vinci, Richard Rogers, Michael Faraday, Tom Cruise, Sir Richard Branson, Charles Schwab. Such excellence out of the classroom is important to maintain self-esteem to compensate for school based failure which is a common experience for dyslexics attending mainstream (non-specialist) school.

Family Life

Family is an important factor to whether dyslexics succeed in life. Researchers such as Alexander-Passe (2007), Riddick (1996) and Scott et al. (1992) have noted the importance of a parent or another adult (e.g. grandparent) that champions the dyslexic and supports them through their difficult school years. This study found that most had

supportive parents and the fact that most also had a parent or another family member of the family that was also dyslexic would suggest that understanding is commonplace. It should be noted that one volunteer found their parents mocking them for frequently asking for help with homework, such behaviour is likely to cause emotional damage as the home is meant to be a safe refuge from the hostilities encountered at school. Riddick (1996) notes how many dyslexics come home frustrated and exhausted from trying hard at school and there is a need for home life to be as calm and conflict-free as possible as a response.

Emotional Stability

This study has found the life of a teenager with dyslexia is hard. They were commonly embarrassed by their dyslexia and perceived that it limits them in life, which would affect their self-esteem and ability to create realistic life goals, which in turn would affect motivation, and thus school performance. Results suggest that dyslexics are frustrated from having a learning difficulty in a world that relies on literacy to access most aspects of life, one volunteer even noted that her love for music was delayed several years until she was able to read music. Literacy is the key to life and affects everyday tasks such as reading a bus timetable, finding out what is on at local cinemas to reading restaurant menus and road signs. Edwards (1994) notes how teachers underestimate how much literacy is required in all school subjects and that being a dyslexic at school is highly frustrating. Alexander-Passe (2008b, c) suggests that dyslexics will deal with their dyslexia by either emotional or behavioural defence mechanisms as a response to difficulties at school.

Conclusions

The audio-interviews found that teenagers with dyslexia experience several difficulties which affects school, home and their social life and that this experience is commonly a negative one. They are commonly frustrated by their difficulties and feel that these limit them in life and limit their ability to communicate effectively, compared to their peers. School-aged children and especially teenagers crave to be accepted members of their peer group and their school difficulties spill out into life outside of school, not only from being excluded from their peer group for being different, but their self exclusion to protect themselves from being embarrassed when asked to read something or make choices. Hales (1995) suggests that dyslexia is not only a misunderstood disability but a hidden disability as well, noting those with physical disabilities are more likely to gain allowances e.g. ramps for wheelchair access, braille in elevators or compassion and understanding.

INVESTIGATION THREE – CORRELATED FACTORS

Investigation One used a battery of standardised measures to begin the process of creating profiles to understand how dyslexic teenagers cope. Mean and standard deviation data was useful at looking at comparing other dyslexic and non-dyslexic populations. Gender data was seen as an important variable in understanding how different dyslexics cope, however further analysis maybe a better way to build such profiles. Alexander-

Passe (2004a) suggests that correlations and factor analysis may be valid routes for such further investigation.

Methodology

Two types of analysis were used in this study: Pearson correlations; and factor analysis with Varimax rotations.

Results

Factor analysis was made with the results from the standardised measures noted in Investigation One. Ten items (CFSEI-General, CFSEI-Social, CFSEI-Academic, CFSEI-Parental, CISS-Task, CISS-Emotional, CISS-Avoidance, CISS-Social Diversion, CISS-Distracton, and BDI-Depression) were used for analysis. Two items excluded (CFSEI-Lie scale and CFSEI-Total scale), the first conflicted with the avoidance scale of the CISS and the second was a collective score of several sub-scores. Whilst four factors were originally found with Eigen values above 1 there were too few items in each factor, however further analysis identified that three factors with a variance of 70.1% contained enough items of each measure to be stable, see Table 11.

Table 12 notes the Varimax rotation matrix with Kaiser normalization and their correlations sorted by size. It suggests three factors which are detailed in table 13 with the names: Avoiding, Trying and Feeling good.

Discussion and Conclusions

The three factors are described as:

Avoiding: Dyslexic teenagers using the avoiding factor use Avoidance-orientated coping (avoiding tasks especially school work), Emotional-orientated coping (self-blame or blaming others for their difficulties) along with Distraction (strategies to distract the self from correcting work) as a coping strategy.

Trying: Dyslexic teenagers using the trying factor use Task-orientated coping (learning from past attempts at work) resulting in high Academic Self-esteem (perceptions of their academic abilities) with negative ratings for Social Diversion (strategies to avoid socialising with peers to avoid situations that would rely on literacy) strategies and Depression (feeling low and helpless to help their situation).

Feeling Good: Dyslexic teenagers using the Feeling Good suggest that General (overall perception of self-worth), Parental (perceived relationship with parents and status at home), and Social (perceived relationship with peers) self-esteems are linked.

It is hypothesised that these three factors are independent of one another, however such factors need to be correlated to another measure as a means of measurement. Investigation Four will investigate correlations of the three hypothetically independent factors to an experimental parental measure.

INVESTIGATION FOUR – PARENTAL QUESTIONNAIRE

Building on Investigations One to Three, Investigation Four describes the search for an instrument to measure how teenagers cope, using parental responses in an experimental measure. This method was chosen as it was hypothesised that teenagers did not have the life experiences to complete a questionnaire which compared their coping to their peers. It was also hypothesized that teachers would be too busy and lack the in-depth knowledge of individual students to make detailed assessments about an individual child's coping strategies. However, parents were seen to not only have the in-depth knowledge but the time and motivation to complete a questionnaire that would inform them and others (e.g. teachers) to how their dyslexic child is coping.

INVESTIGATION FOUR – PARENTAL QUESTIONNAIRE

Building on Investigations One to Three, Investigation Four describes the search for an instrument to measure how teenagers cope, using parental responses in an experimental measure. This method was chosen as it was hypothesised that teenagers did not have the life experiences to complete a questionnaire which compared their coping to their peers. It was also hypothesized that teachers would be too busy and lack the in-depth knowledge of individual students to make detailed assessments about an individual child's coping strategies. However, parents were seen to not only have the in-depth knowledge but the time and motivation to complete a questionnaire that would inform them and others (e.g. teachers) to how their dyslexic child is coping.

Hypothetical Models of Coping

The parental questionnaire is an experimental measure which is aimed at parents and their ability to answer subjectively about how their child will react to certain experiences and situations. Eight types of questions were isolated from empirical studies (e.g. Riddick, 1996; Edwards, 1994) and are detailed in table 14, based on four hypothetical models of coping identified. These were called: Striving, Dodging, Disrupting and Withdrawing. These basic coping strategies were hypothesised as:

- Strategy 1: Sometimes children will 'buckle down' and work very hard to overcome their problems, especially by focusing their energies on subjects they can excel in. This strategy might be called 'Striving'.
- Strategy 2: Sometimes children will just avoid words/tasks they are unsure of, thus avoiding experimentation and new learning experiences. This could be called 'Dodging'.
- Strategy 3: Sometimes children will use classroom disruption to try to gain attention from teachers. This strategy might be called 'Disrupting'.
- Strategy 4: Sometimes children will feel there is little point carrying on with school, leading to withdrawal and despair. They feel very different from their peers and this makes them feel even more isolated. This strategy might be called 'Withdrawing'.

Table 11. Factor Analysis identifying three factors with a cumulative 70.9% loading

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.383759	43.83759	43.83759	4.383759	43.83759	43.83759	2.895626	28.95626	28.95626
2	1.569771	15.69771	59.5353	1.569771	15.69771	59.5353	2.285838	22.85838	51.81464
3	1.144865	11.44865	70.98395	1.144865	11.44865	70.98395	1.916931	19.16931	70.98395
4	1.024788	10.24788	81.23183						
5	0.663387	6.63387	87.8657						
6	0.402278	4.02279	91.88848						
7	0.366788	3.66789	95.55636						
8	0.212051	2.120513	97.67687						
9	0.145665	1.45665	99.13352						
10	0.086648	0.86648	100						

Table 12. Variamax Rotation Matrix

Rotated Component Matrix(a)			
Items	Components		
	1	2	3
CS03	0.841927209	-0.294549289	-0.17127
CS04	0.800618103	-0.100486952	-0.05249
CS02	0.710264348	0.031236103	-0.43521
CS01	0.17552916	0.919334182	0.026567
CF04	-0.28537647	0.714627291	0.145419
CS05	0.590513625	-0.645956554	-0.05393
BD01	0.481604067	-0.602905912	-0.17909
CF03	0.103239483	0.045354689	0.860078
CF02	-0.4828464	0.191039963	0.723595
CF05	-0.323440011	0.113267706	0.6126

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.

Table 13. Details of the three factors identified

Factor 1 (Avoiding)			
CS03	Avoidance	0.841927209	High avoidance coping
CS04	Distraction	0.800618103	High distraction coping
CS02	Emotion	0.710264348	High emotion coping
Factor 2 (Trying)			
CS01	Task	0.919334182	High task coping
CF04	Academic SE	0.714627291	High academic self-esteem
CS05	Social Diversion	-0.645956554	Low social diversion coping
BD01	Depression	-0.602905912	Low depression
Factor 3 (Felling good)			
CF03	Social SE	0.860078155	High social self-esteem
CF02	General SE	0.723595254	High general self-esteem
CF05	Parental SE	0.612599571	High parental self-esteem

Strategy 1: Striving

Support for identification of Strategy 1 comes from Reiff, Gerber, & Ginsberg's (1997) study of successful learning disabled adults (dyslexics), with findings of persistence and stubbornness as assets, as also found by Wszeborska-Lipinska (1997) with dyslexic university students in Poland. Scott et al.'s (1992) study also distinguishes between 'successful' and 'unsuccessful' adults with learning disabilities (an American name for dyslexia and other similar difficulties). The key factors for successful dyslexics were supportive family background, early identification, encouragement of talents and hobbies and a search for self worth. Reiff, Gerber, & Ginsberg (1993) also commented 'in almost all cases, learning disabilities necessitate alternative approaches to achieve vocational success'.

Strategy 2: Dodging

Support for identification of Strategy 2 comes from Morgan and Klein (2001, p. 94-95). They note that 'the childhood experiences of being labelled 'thick', the public humiliation caused by failing often resulted in choices, which reinforced low self-esteem and led dyslexic individuals to avoid areas requiring reading and writing'. Many dyslexic people choose careers that place limited demands on language skills as a conscious strategy to avoid jobs with heavy requirements for reading and writing. In the empirical review, it was noted that there is a growing body of evidence to suggest that children with dyslexia avoid tasks, which highlight their difficulties. Unfortunately much of this is based on small-scale qualitative studies. High on the list of causes are the ways in which teachers and schools deal with failure (Fontana, 1995, p. 168) 'Too often the teacher instils in children a fear of making mistakes and of showing their failure to understand, and this leads to conservative and stereotyped patterns of learning which inhibit reflective thinking and a genuine grasp of the principles upon which knowledge is based'. Riddick (1996, p. 131) also suggests 'by secondary age all [dyslexics in her study] children claim that they avoid difficult to spell words and over half of them claim that they put off or avoid doing writing'.

Strategy 3: Disrupting

Support for identification of Strategy 3 comes from The Dyspel Pilot Project (Klein and Sunderland, 1998). They found dyslexic offenders talking of distressing memories of school, including frequent public humiliation in front of their peers, and violent outbursts in response to frustration at not learning and being mocked, humiliated or called stupid. Molnar and Lindquist (1989) also found that pupils might disrupt a class because they interpret the class work as threatening, and use attention seeking to protect self-esteem. Thomson (1996) notes 'over'-reactions to stress in dyslexics, e.g. trying to be seen as successful in other areas, being the class clown, hiding their failure under a 'couldn't care less' attitude and manifesting silly behaviour.

Strategy 4: Withdrawing

Support for identification of Strategy 4 comes from Riddick (1996), who found that dyslexic primary and secondary school children reported themselves as disappointed, frustrated, ashamed, fed up, sad, depressed, angry and embarrassed by their dyslexic difficulties. Ryan (1994) in particular noted that depression is a frequent complication in dyslexia. In addition, Edwards (1994, p. 61) noticed that some dyslexics suffer from competitiveness disorders, with many withdrawing both academically and socially 'Gareth only tries hard if he thinks he can win, if not he merely gives up.... Nevertheless, he had to be very sure of his good standard before making himself vulnerable again'. Support also comes from Morgan (1997), who found that if academic success cannot give dyslexics self-worth, then they begin to withdraw from classroom activities (negative environments). Gardner (1994) found that dyslexics were prone to withdraw from situations in which they perceive that they cannot cope (e.g. spelling tests). This withdrawal can be both from specific lessons and for whole days. Withdrawal for long or frequent periods can also be caused by a reaction to certain teachers who humiliate them in front of their peers. Another aspect of school refusal is shown by those individuals who develop psychosomatic disorders or other illnesses to avoid school: 'I used to pretend I was sick, make myself puke, and say I don't wanna go today', one dyslexic teenager commented (Edwards 1994, p. 110).

Interestingly, support for strategies 3 and 4 (Disrupting and Withdrawing) also comes from The UK's Audit Commission (2002a), who have noted that 87% of the primary school pupils and 60% of the secondary school pupils who were permanently excluded had SEN statements. They were also very concerned about the significant over-representation of these pupils in national non-attendance and exclusion statistics, noting SEU's (1999) findings of clear links between poor attendance and under-achievement.

Strategy Summary

Children were thought of as using any of these four strategies at different times for different tasks, but it was expected that one strategy would be used more than others (a dominant strategy).

Methodology

Using the eight types of questions as noted in Tables 14, Table 15 begins to build up the model for the parental questionnaire. From these cells the questionnaire was built, and is shown in Table 16, with Table 17 indicating additional items to gain basic information about the teenage subjects and their parents, additional questions which placed at the start of the measure.

Table 14. Eight types of questions in the PQ

Please describe how you perceive your dyslexic teenager's general personality.
Please describe how your dyslexic teenager reacts to success.
Please describe how your dyslexic teenager reacts to failure.
Please describe the type of support they get.
Please describe their attitude to school.
Please describe how your dyslexic teenager deals with school.
Please describe how you think his/her teachers perceive your dyslexic teenager.
Please describe how you (as the parents) perceive your dyslexic teenager at school.

Table 15. Intuitively expected responses to each of the four hypothesised coping strategies

	<i>Strategy 1: Striving</i>	<i>Strategy 2: Dodging</i>	<i>Strategy 3: Disrupting</i>	<i>Strategy 4: Withdrawing</i>
<i>General personality</i>	Will try new tasks and has a positive outlook to life. Never secretive.	Will frequently try new tasks with a generally positive outlook to life. Sometimes secretive.	Will sometimes try new tasks with a generally negative outlook to life. Frequently secretive.	Will never try new tasks, depressive and very negative about life. Very secretive.
<i>How they react to success</i>	Will always expect success and is willing to take risks to gain success.	Will frequently expect success and will frequently take risks to gain success.	Will sometimes expect success and will only sometimes take risks to gain success.	Will never expect success and will never take risks to gain success.

Table 15. (Continued)

	<i>Strategy 1: Striving</i>	<i>Strategy 2: Dodging</i>	<i>Strategy 3: Disrupting</i>	<i>Strategy 4: Withdrawing</i>
<i>How they react to failure</i>	Will never expect to fail and will always attempt the task again. Will always handle failure well.	Will sometimes expect to fail and will sometimes attempt the task again. Will frequently handle failure well.	Will frequently expect to fail and will frequently be put off attempting the task again. Will sometimes handle failure well.	Will always expect to fail and will always be put off attempting the task again. Will never handle failure well.
<i>What support do they get</i>	Can attract support from their parents, peers and teachers.	Can't attract support from their teachers, since they cover up their dyslexia.	Negate all chance of support as their disruptive behaviour is seen as the main problem.	Support from anyone is refused.
<i>Attitude towards school</i>	Worthwhile.	Sometimes worthwhile.	Not worthwhile.	Not at all worthwhile.
<i>How they deal with school</i>	Always realistic about their abilities at school. Always react well to school tests. Many (5+) friends at school.	Frequently realistic about their abilities at school. Frequently react well to school tests. Few (3-5) friends at school.	Sometimes realistic about their abilities at school. Sometimes react well to school tests. Some (2-3) friends at school.	Never realistic about their abilities at school. Never react well to school tests. No (0-1) friends at school.
<i>How teachers perceive them in school</i>	Always confident and/or ambitious. Always have a positive outlook to schoolwork. No behavioural problems in class.	Frequently confident and/or ambitious. Frequently have a positive outlook to schoolwork. Some behavioural problems in class.	Sometimes confident and/or ambitious. Sometimes have a positive outlook to schoolwork. Frequent behavioural problems in class.	Never confident and/or ambitious. Never have a positive outlook to schoolwork. Consistent behavioural problems in class.

Table 16. Parental Questionnaire (PQ-2)

<i>A</i>	<i>Please describe how YOU perceive your dyslexic teenager's general personality</i>				
<i>A01</i>	Will or won't try new things e.g. foods, skills, games etc	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>A02</i>	Is realistic about his/her abilities in school, hobbies, sports etc	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>A03</i>	Is open/secretive about school or other events in his/her life	<input type="radio"/> Very open	<input type="radio"/> Fairly open	<input type="radio"/> Fairly secretive	<input type="radio"/> Very secretive
<i>A04</i>	Has a positive or negative outlook on life	<input type="radio"/> Very positive	<input type="radio"/> Fairly positive	<input type="radio"/> Fairly negative	<input type="radio"/> Very negative
<i>A05</i>	Is happy or depressed about life/school	<input type="radio"/> Very happy	<input type="radio"/> Fairly happy	<input type="radio"/> Fairly depressed	<input type="radio"/> Very depressed
<i>B</i>	<i>Please describe how your dyslexic teenager reacts to success</i>				
<i>B01</i>	Does he/she expect success?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>B02</i>	Does he/she take risks to gain success?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>B03</i>	Is he/she encouraged by success from school/hobbies/sports?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never

Table 16. (Continued).

B04	Attributes school/hobbies/sport success to his/her luck/ability?	<input type="radio"/> Purely ability	<input type="radio"/> Generally ability	<input type="radio"/> Generally luck	<input type="radio"/> Purely luck
C	<i>Please describe how your dyslexic teenager reacts to failure</i>				
A	<i>Please describe how YOU perceive your dyslexic teenager's general personality</i>				
C01	Does he/she expect failure?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
C02	Attributes school/hobbies/sport failure to 'impossible tasks'?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
C03	Is discouraged by failure from school/hobbies/sports?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
C04	Attributes school/hobbies/sport failure to his/her luck/ability?	<input type="radio"/> Purely ability	<input type="radio"/> Generally ability	<input type="radio"/> Generally luck	<input type="radio"/> Purely luck
C06	How does he/she feel following failure?	<input type="radio"/> Very encouraged	<input type="radio"/> Generally encouraged	<input type="radio"/> Fairly discouraged	<input type="radio"/> Very discouraged
C07	Holds himself/herself responsible for failure?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
C08	Does he/she think he/she handles failure situations well?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
D	<i>Please describe how your dyslexic teenager deals with school</i>				
D02	Does your son/daughter have many friends in school?	<input type="radio"/> Many (5+)	<input type="radio"/> Some (3-5)	<input type="radio"/> Few (2-3)	<input type="radio"/> One or none (0-1)
D03	Who supports him/her when he/she is depressed from the school day?	<input type="radio"/> Parents & peers	<input type="radio"/> Peers only	<input type="radio"/> Parents only	<input type="radio"/> Neither parents nor peers
D04	Does he/she react to examinations or tests well?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
D05	Is he/she academically realistic about his/her ability?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
D06	How often does he/she avoid writing or spelling tasks?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
D07	Does he/she have access to a personal computer to aid in studies (writing essays etc)?	<input type="radio"/> All of the time	<input type="radio"/> Most of the time	<input type="radio"/> Some of the time	<input type="radio"/> Never
D08	Does he/she use highlight markers to aid in studies?	<input type="radio"/> All of the time	<input type="radio"/> Most of the time	<input type="radio"/> Some of the time	<input type="radio"/> Never
D09	Does he/she have a private tutor to aid in studies?	<input type="radio"/> All of the time	<input type="radio"/> Most of the time	<input type="radio"/> Some of the time	<input type="radio"/> Never
D10	Does he/she use other pupils or siblings to aid his/her studies?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
E	<i>Please describe how you think your dyslexic teenager is perceived by his/her TEACHERS</i>				
E01	As intelligent?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
E02	As ambitious?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
E03	As having a positive outlook to his/her school studies?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
E04	As encouraged or discouraged by poor marks from tests or tasks?	<input type="radio"/> Very encouraged	<input type="radio"/> Fairly encouraged	<input type="radio"/> Fairly discouraged	<input type="radio"/> Very discouraged
E05	As confident in class?	<input type="radio"/> Very confident	<input type="radio"/> Fairly Confident	<input type="radio"/> Not very confident	<input type="radio"/> Not confident at all

Table 16. (Continued)

E06	As exhibiting behavioral problems in class?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
E07	As encouraged or discouraged by good marks in tests or tasks?	<input type="radio"/> Very encouraged	<input type="radio"/> Fairly encouraged	<input type="radio"/> Fairly discouraged	<input type="radio"/> Very discouraged
A	<i>Please describe how YOU perceive your dyslexic teenager's general personality</i>				
E08	As likely to do well or poorly 'career wise' after leaving school?	<input type="radio"/> Very well	<input type="radio"/> Fairly well	<input type="radio"/> Fairly poorly	<input type="radio"/> Very poorly
E09	As positive or negative towards his/her having dyslexia?	<input type="radio"/> Very positive	<input type="radio"/> Fairly positive	<input type="radio"/> Fairly negative	<input type="radio"/> Very negative
E10	As positive or negative towards his/her dyslexia/SpLD assessment?	<input type="radio"/> Very positive	<input type="radio"/> Fairly positive	<input type="radio"/> Fairly negative	<input type="radio"/> Very negative
F	<i>Please describe how YOU perceive your dyslexic teenager at school</i>				
F01	As academically hard working?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F02	Failure makes him/her give up trying in class or doing homework?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F03	As recognized for his/her talents in school by teachers?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F04	As encouraged to do homework by his/her teachers?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F05	As understood by teachers as having specific educational needs?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F06	As granted allowances by teachers regarding his/her dyslexia?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F07	As truanting or using other ways to avoid school/classes/tests etc.?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F08	As coming home from school frustrated by his/her dyslexia?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F10	As emotionally scarred from dyslexia-related failure?	<input type="radio"/> Deeply	<input type="radio"/> Seriously	<input type="radio"/> Somewhat	<input type="radio"/> Not at all

Table 17. Supplementary information requested on the PQ

Your name	
Your son's/daughter's name taking part in this study	
Today's date	
Relationship to your son/daughter	<input type="radio"/> Mother <input type="radio"/> Father <input type="radio"/> Step-parent <input type="radio"/> Other
Your son's/daughter's date of birth	
Which school year is your son/daughter in?	

Results

The (N=44 item) parental questionnaire (PQ-1) was first used in a Pilot study with N=10 participants, N=8 were returned (along with the battery of standardised measures and audio interview). The Pilot study data (See Table 17 for the mean percentage data) suggested that Strategy 2 (Dodging) was dominant, followed by Strategy 3 (Disrupting). Feedback from the Pilot study suggested changes to wording on several items and the need to separate certain joint questions, the additional items were added to create a new N=47 item Parental Questionnaire (PQ-2) and used with the Main study sample of N=76 dyslexic teenagers, N=18 were returned (along with the battery of standardised measures and audio interview). The Main study data (See Table 17) suggested that Strategy 3 (Disrupting) was dominate, followed by Strategy 2 (Dodging), which was a reverse to the Pilot Study. Overall it found Strategy 3 (Disrupting) was the most dominant, followed closely by Strategy 2 (Dodging), then Strategy 1 (Striving) with Strategy 4 (Withdrawing) marginally used.

Whilst the use of the Dodging and Disrupting strategies differ (both still indicate high frequencies), this might be related to peculiarities among samples, however the low use of the Striving and Withdrawing strategies seems constant. The 19.6% Striving score seems to suggest that a fifth of teenage dyslexics are more able to cope with school, with the 6.8% Withdrawing score suggesting a core of dyslexics who maybe highly affected by their difficulties are at risk of depression.

Table 18. Mean percentage data (and Standard Deviations) for the four hypothetical strategies

<i>Means (SD)</i>	<i>Strategy 1: Striving</i>	<i>Strategy 2: Dodging</i>	<i>Strategy 3: Disrupting</i>	<i>Strategy 4: Withdrawing</i>
<i>Pilot Study</i>	19.2 (13.8)	42.5 (10.1)	30.2 (9.8)	7.8 (4.7)
<i>Main Study</i>	19.7 (14.5)	34.2 (12.5)	39.4 (11.7)	6.5 (5)
<i>Overall</i>	19.6 (14)	36.4 (12.3)	39.9 (11.8)	6.8 (1.9)

Results – Pearson Correlations

Whilst the mean data in Table 17 gives interesting results they are purely based on parental perceptions and are not validated to child's scores. Thus to do this, the Factor analysis results of Investigation Four were required to be correlated to the N=47 Parental Questionnaire Items. These results are indicated in Table 18 indicating only N=22 of the N=47 PQ-2 items were correlated, with all the items in both pilot and main study (PQ1 + PQ2) included. In Table 19 the items have been up into questionnaire format to check if they are logical for inclusion in PQ-3 - the final correlated version.

Table 19. Pearson Correlations from PQ-2

<i>Code</i>	<i>Pearson Correlations (1 tailed)</i>	<i>FACTOR 1 (Avoiding)</i>	<i>FACTOR 2 (Trying)</i>	<i>FACTOR 3 (Feeling Good)</i>
<i>A01</i>	Will or won't try new things e.g. foods, skills, games etc	0.03043997	0.1997464	0.497024427
<i>A02</i>	Realistic about his/her abilities in school, hobbies, sports etc	-0.3162665	0.0758116	0.052124705
<i>A04</i>	Has a positive or negative outlook on life	0.03170966	-0.060567	0.377073519
<i>B01</i>	Does he/she expect success?	-0.0056007	-0.349858	-0.182485847
<i>B04</i>	Attributes school/hobbies/sport success to his/her luck/ability?	-0.3250487	-0.1114882	0.553976635
<i>C01</i>	Does he/she expect failure?	-0.0806569	0.1804239	0.409811036
<i>C02</i>	Attributes school/hobbies/sport failure to 'impossible tasks'?	-0.0274948	-0.0488677	0.426181943
<i>C06</i>	How does he/she feel following failure?	-0.3528623	0.0631318	0.127737702
<i>C07</i>	Holds himself/herself responsible for failure?	-0.1068529	0.3858011	-0.149808012
<i>D02</i>	Does your son/daughter have many friends in school?	-0.3863846	0.1277393	-0.475000362
<i>D10</i>	Does he/she use other pupils or siblings to aid his/her studies?	-0.0761909	0.3224935	0.04500999
<i>E02</i>	As ambitious?	0.00332137	-0.0316744	0.44029323
<i>E07</i>	As encouraged or discouraged by good marks in tests or tasks?	-0.4661169	-0.0744008	0.290824804
<i>E10</i>	As positive or negative towards his/her dyslexia/SpLd assessment?	-0.3215591	0.0711505	0.29873063
<i>F02</i>	Failure makes him/her give up trying in class or doing homework?	0.11267899	0.1642253	-0.62598999
<i>F04</i>	As encouraged to do homework by his/her teachers?	-0.3352056	-0.3647727	0.403980045
<i>F05</i>	As understood by teachers as having specific educational needs?	-0.4556841	0.2955466	0.353887688
<i>F06</i>	As granted allowances by teachers regarding his/her dyslexia?	-0.0358785	0.4919272	-0.028713632
<i>F07</i>	As truanting or using other ways to avoid school/classes/tests etc.?	0.39756894	-0.2950427	-0.420614167
<i>F08</i>	As coming home from school frustrated by his/her dyslexia?	0.00827328	0.2132778	-0.340410571
<i>F09</i>	As coming home from school exhausted by his/her dyslexia?	-0.2090728	0.37186	0.072220512
<i>F10</i>	As emotionally scarred from dyslexia-related-failure?	0.11182571	-0.1038943	-0.49550803

Table 20. Items identified by Pearson Correlations in PQ-2 for the final questionnaire (PQ-3)

<i>Code</i>	<i>Parental Questionnaire Item</i>	<i>FACTOR 1 (Avoiding)</i>
C06	How does he/she feel following failure?	Negative
E10	As positive or negative towards his/her dyslexia/SpLd assessment?	Negative
A02	Realistic about his/her abilities in school, hobbies, sports etc	No
B04	Attributes school/hobbies/sport success to his/her ability?	No
D02	Does your son/daughter have many friends in school?	No
E07	As encouraged by good marks in tests or tasks?	No
F04	As encouraged to do homework by his/her teachers?	No
F05	As understood by teachers as having specific educational needs?	No
F07	As truanting or using other ways to avoid school/classes/tests etc.?	yes
<i>Code</i>	<i>Parental Questionnaire Item</i>	<i>FACTOR 2 (Trying)</i>
F04	As encouraged to do homework by his/her teachers?	No
B01	Does he/she expect success?	No
C07	Holds himself/herself responsible for failure?	yes
D10	Does he/she use other pupils or siblings to aid his/her studies?	yes
F06	As granted allowances by teachers regarding his/her dyslexia?	yes
F09	As coming home from school exhausted by his/her dyslexia?	yes
<i>Code</i>	<i>Parental Questionnaire Item</i>	<i>FACTOR 3 (Feeling Good)</i>
D02	Does your son/daughter have many friends in school?	No
F07	As truanting or using other ways to avoid school/classes/tests etc.?	No
C01	Does he/she expect failure?	No
F02	Failure makes him/her give up trying in class or doing homework?	No
F08	As coming home from school frustrated by his/her dyslexia?	No
F10	As emotionally scarred from dyslexia-related-failure?	No
F04	As encouraged to do homework by his/her teachers?	yes
B04	Attributes school/hobbies/sport success to his/her ability?	yes
F05	As understood by teachers as having specific educational needs?	yes
A01	Will try new things e.g. foods, skills, games etc	yes
A04	Has a positive or negative outlook on life	yes
C02	Attributes school/hobbies/sport failure to 'impossible tasks'?	yes
E02	As ambitious?	yes

Results – Scoring the PQ

The PQ-1 and PQ-2 was designed with a choice of four responses, normally two negative and two positive, this was to avoid responders answering with a non-preference selection. In designing a method to score the PQ, it was found the initial values assigned to the four responses meant that the PQ was hard to score. Thus it was concluded that the Feeling Good factor would be high scoring and the Avoiding and Trying factors would be low scoring, thus allowing a comparison of the one self-esteem factor to the two coping factors. The Avoiding and Trying factors were reversed to be Not Avoiding and Not Trying. Also as noted in table 17, certain items (e.g. B04, D02, F04 & F07) were used by more than one factor but with differing negative and positive correlations.

To score the PQ (see table 20), the higher the Feeling Good score, equals a higher self-esteem (there are N=13 items, thus the highest score is 52 and the lowest is 13). In the case of

the Not Avoiding factor, a low score equal higher use of avoiding (there are N=9 items thus the lowest score is 9 and 36 is the highest). Likewise with the Not Trying factor, a low score equals high use of Trying (there are N=6 items, thus 6 is the lowest score and 24 is the highest).

Graph 1 details the results for the Pilot and Main study participants, sorted using the Feeling Good factor and linear lines to denote trends. The results suggest that whilst the individual’s self-esteem may rise (the Feeling Good factor is correlated to General, Social and Parental self-esteem) this has a minimal affect on the Not Trying factor (made up of Task-orientated coping and Academic self-esteem with negative use of Depression and Social Diversion strategies), but has a positive effect of the Not Avoiding factor (made up of both Emotional and Avoidance-orientated coping and distraction strategies).

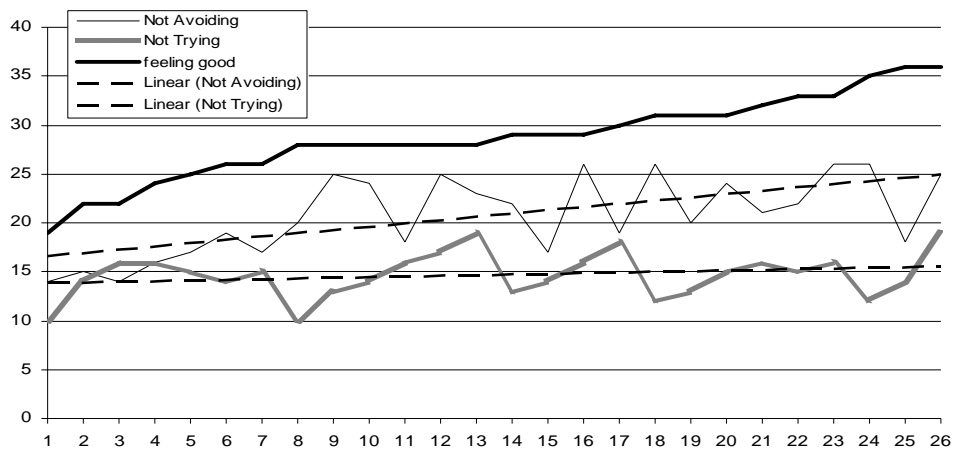
Graphs 2 and 3 show the results for the gender breakdowns, they suggest that males and females score differently on the PQ. The male data indicates that both the Not Trying and the Not Avoiding factors have a positive effect to the Feeling Good factors. The female data however suggests that similar to the overall result, that Not Trying is not affected by the Feeling Good Factor, however there is a steeper positive effect with the Not Avoiding factor data.

Table 21 details the final parental questionnaire (PQ-3) which has been validated to the three factors as identified by standardised measures used with dyslexic teenagers.

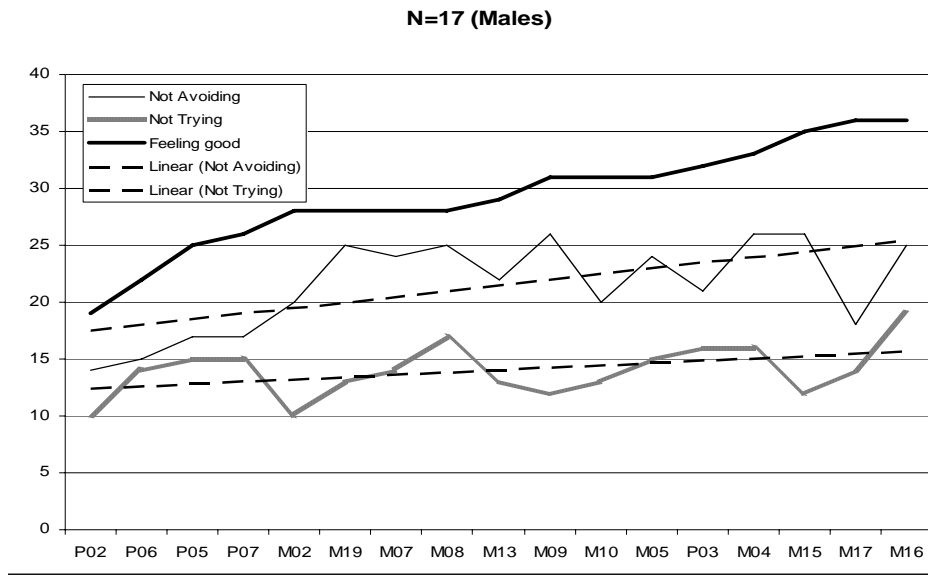
Table 21. PQ-3 Scoring guide

<i>FACTOR</i>	<i>LOW SCORE</i>	<i>HIGH SCORE</i>
<i>Feeling Good</i>	Low Self-esteem	High Self-esteem
<i>Not Avoiding</i>	High Avoiding	Low Avoiding
<i>Not Trying</i>	High Trying	Low Trying

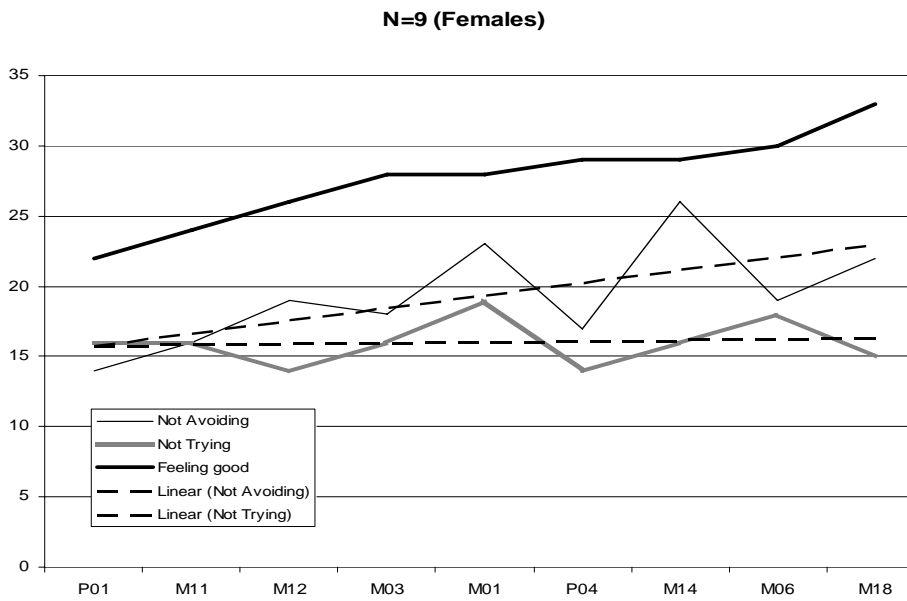
N=27 (All)



Graph 1. All Pilot and Main Study, Overall data, N=26.



Graph 2. Pilot and Main Study, Male data only, N=17.



Graph 3. Pilot and Main Study, Female data only, N=9.

Table 22. Parental Questionnaire (PQ-3)

Your name	
Your dyslexic son's/daughter's name	
Today's date	
Relationship to your son/daughter	<input type="radio"/> Mother <input type="radio"/> Father <input type="radio"/> Step-parent <input type="radio"/> Other
Your dyslexic son's/daughter's date of birth	
Which school year is your son/daughter in?	

<i>A</i>	<i>Please describe how YOU perceive your dyslexic teenager's general personality</i>				
<i>A01</i>	Will or won't try new things e.g. foods, skills, games etc	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>A02</i>	Is realistic about his/her abilities in school, hobbies, sports etc	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>A04</i>	Has a positive or negative outlook on life	<input type="radio"/> Very positive	<input type="radio"/> Fairly positive	<input type="radio"/> Fairly negative	<input type="radio"/> Very negative
<i>B</i>	<i>Please describe how your dyslexic teenager reacts to success</i>				
<i>B01</i>	Does he/she expect success?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>B04</i>	Attributes school/hobbies/sport success to his/her luck/ability?	<input type="radio"/> Purely ability	<input type="radio"/> Generally ability	<input type="radio"/> Generally luck	<input type="radio"/> Purely luck
<i>C</i>	<i>Please describe how your dyslexic teenager reacts to failure</i>				
<i>C01</i>	Does he/she expect failure?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>C02</i>	Attributes school/hobbies/sport failure to 'impossible tasks'?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>C06</i>	How does he/she feel following failure?	<input type="radio"/> Very encouraged	<input type="radio"/> Generally encouraged	<input type="radio"/> Fairly discouraged	<input type="radio"/> Very discouraged
<i>C07</i>	Holds himself/herself responsible for failure?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>D</i>	<i>Please describe how your dyslexic teenager deals with school</i>				
<i>D02</i>	Does your son/daughter have many friends in school?	<input type="radio"/> Many (5+)	<input type="radio"/> Some (3-5)	<input type="radio"/> Few (2-3)	<input type="radio"/> One or none (0-1)
<i>D10</i>	Does he/she use other pupils or siblings to aid his/her studies?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>E</i>	<i>Please describe how you think your dyslexic teenager is perceived by his/her TEACHERS</i>				
<i>E02</i>	As ambitious?	<input type="radio"/> Always	<input type="radio"/> Frequently	<input type="radio"/> Sometimes	<input type="radio"/> Never
<i>E07</i>	As encouraged or discouraged by good marks in tests or tasks?	<input type="radio"/> Very encouraged	<input type="radio"/> Fairly encouraged	<input type="radio"/> Fairly discouraged	<input type="radio"/> Very discouraged
<i>E10</i>	As positive or negative towards his/her dyslexia/SpLD assessment?	<input type="radio"/> Very positive	<input type="radio"/> Fairly positive	<input type="radio"/> Fairly negative	<input type="radio"/> Very negative

Table 22. (Continued).

<i>F</i>	<i>Please describe how YOU perceive your dyslexic teenager at school</i>				
F02	Failure makes him/her give up trying in class or doing homework?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F04	As encouraged to do homework by his/her teachers?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F05	As understood by teachers as having specific educational	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F06	As granted allowances by teachers regarding his/her	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F07	As truanting or using other ways to avoid	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F08	As coming home from school frustrated by his/her dyslexia?	<input type="radio"/> Always	<input type="radio"/> Most of the time	<input type="radio"/> Rarely	<input type="radio"/> Never
F10	As emotionally scarred from dyslexia-related failure?	<input type="radio"/> Deeply	<input type="radio"/> Seriously	<input type="radio"/> Somewhat	<input type="radio"/> Not at all

Discussion

Thus the data suggests that overall, in the case of dyslexic teenagers, the higher their General, Social and Parental self-esteem, the less they will need to use Avoidance and Emotional orientated coping strategies. However General, Social and Parental self-esteem had less affect on Task orientated coping and Academic self-esteem. This is a logical result and suggests that avoiding is a defensive mechanism (as noted by Alexander-Passe, 2008b). In the male data, it also suggests that the higher General, Social and Parental self-esteem they have, the less they will use Avoidance and Emotional orientated coping but interesting by the less they will also use Task-orientated coping which is related to learning from your mistakes. This might suggest that as soon as male dyslexic teenagers feel good about themselves they stop trying at school, an arrogant response. With the female data we see the Not Trying factor is in no shape or form affected by the individuals General, Social and Parental self-esteem (Feeling Good factor) which suggests that males and females are affected by motivation in different ways, with males being more affected and females lesser so.

The female data also suggests that the higher the General, Social and Parental self-esteem score is, the less they feel the need for emotional and avoidance orientated coping.

In all three samples (overall, female and male) there seems to be a negative relationship between the Feeling Good and Avoiding factors which can be explained that when individuals feel better about themselves they have less need for defensive mechanisms (see Alexander-Passe, 2008b). These mechanisms are there to protect them from hostile environments and stressor events which are perceived to attack their self-concept. In the case of dyslexics it can be requests to read aloud in class, to writing a long essay for homework or even taking a telephone message. These tasks might be easy and non-threatening for non-dyslexics, but in the case of dyslexics they are highly stressful and cause them to be constantly on their guard (in case they need to be avoided). Riddick (1996), Edwards (1995) and Alexander-Passe (2003, 2006, 2008a, b) note that avoidance of tasks from using hard to

spell words or writing tasks are the most common strategies used to combat (dyslexia) literacy-related stress.

With the Trying factor, it is interesting that there is a difference in how males and females cope when compared to the Feeling Good factor. The results from the female sample suggest that feeling good about themselves (as noted in General, Social and Parental self-esteem with the Feeling Good factor) has little relationship to the effort they put in at school with learning as noted in the Not Trying factor this is encouraging and suggests a good work ethic. It also suggests that they will put in the same level of effort to learn in good times and bad and they understand that such ups and downs are part of life.

In the case of the males in this study, the level of effort in learning as noted in the Not Trying factor, has a minimal but positive relationship to feeling good about themselves (as noted in the Feeling Good factor). The data suggests that when their General, Social and Parental self-esteem is high they feel less inclined to put in the effort to learn with tasks or at school. Such laziness or motivational issues have also been noted by Vallerand, Fortier and Guay, (1997), Jones and Myhill (2004) and West (1999) and is not confined to dyslexic males. This also has implications for motivation as with the female data, motivation is not dependent on results, however with the dyslexic males there is more chance that this happens.

Looking at Graphs 1 to 3 it would seem that comparing the trends of the Not Avoiding and Not Trying factors, baring in mind that the lower the score the higher the use of that strategy. The overall data indicates a higher use of Not Trying (task-orientated coping) than Not Avoiding (emotional and avoiding-orientated coping) the difference between the two being clear. With the male data, there is a larger differential between the Not Trying and Not Avoiding factors. However with the female data there is less differential suggesting a higher use of the Not Avoiding factor. The data suggests that females use more emotional and avoidance-orientated coping, this finding replicates the results of Investigation One and it is significant that parents can recognise this.

Conclusions

The results from Investigation Four suggest that the parental questionnaire may be a viable means to measure how dyslexic teenagers cope and it was successful enough to be validated and indicate three factors of coping (Not Avoiding, Not Trying and Feeling Good). Investigation Five will investigate if the results found in this small sample are replicated in other samples and age groups.

The N=21 item PQ-3 measure is designed to be easily completed by parents and for the results to inform them, and their teenage child's teachers to how their child is coping at school. It is envisaged that parents would use the results from such a measure to pressure teachers and schools to give increased assistance in the classroom to counteract the negative aspects of having a learning disability in mainstream education. If it only highlights to their teacher and school the negative affects of their inability to cope at their school, then it would be a positive step in recognising that dyslexia is not just a problem affecting literacy, but a problem that affects all curriculum areas, relationships with parents, peers and teachers along with emotional and behavioural aspects.

INVESTIGATION FIVE – CONFIRMING THE PARENTAL QUESTIONNAIRE

The knowledge gained in the literature review and Investigations One to Four suggest that dyslexic teenagers are a unique group in how they cope. Using standardised measure, their scores suggest that they experience very low self-esteem, above average use of emotional and avoidance-orientated coping and differing levels of depression. The audio interviews gave an interesting profile suggesting that avoidance of writing tasks and using hard to spell words mean that they waste vital energy in avoiding situations that would embarrass them due to their learning difficulty. Many felt that being dyslexic limited them in life and they were frustrated and angry as a reaction to learning in environments that ignored their unique difficulties. It was therefore hypothesized that a parental questionnaire was a valid means to identify how dyslexic teenagers cope as parents had both the time, life knowledge and knowledge of their child to answer a questionnaire, such was not perceived to be found with the teenagers themselves nor their school teachers. The experimental questionnaire was validated to the results of the teenage dyslexics using standardised measures and N=28 items out of N=47 were validated to the three factors identified. Whilst a measure for diagnosed dyslexic teenagers is useful, a measure that could be used by undiagnosed samples and samples with varying ages would be of greater value. Investigation Five now looks as a broader range of samples to investigate if similar results can be replicated.

Methodology

Three UK dyslexia associations were contacted in different parts of the country to take part in the study, Two agreed to take part (Birmingham Dyslexia Association and Enfield [London] Dyslexia Association), each were sent 75 of the N=47 item parental questionnaires (PQ-2) with freepost addressed reply envelopes for enclosure with their forthcoming newsletter mailings. They were instructed to place them in random envelopes if their mailings were in excess of 75 families. N=35 questionnaires were returned, however N=2 were excluded due to many items being unanswered.

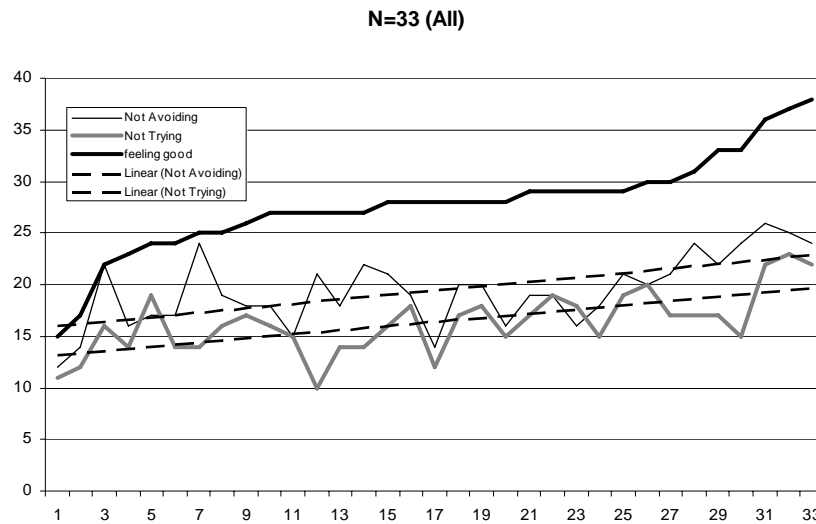
In addition, N=9 non-dyslexic sibling questionnaires were received, but as this group was too small for analysis they were also excluded from the study.

Results – Overall and Gender Data

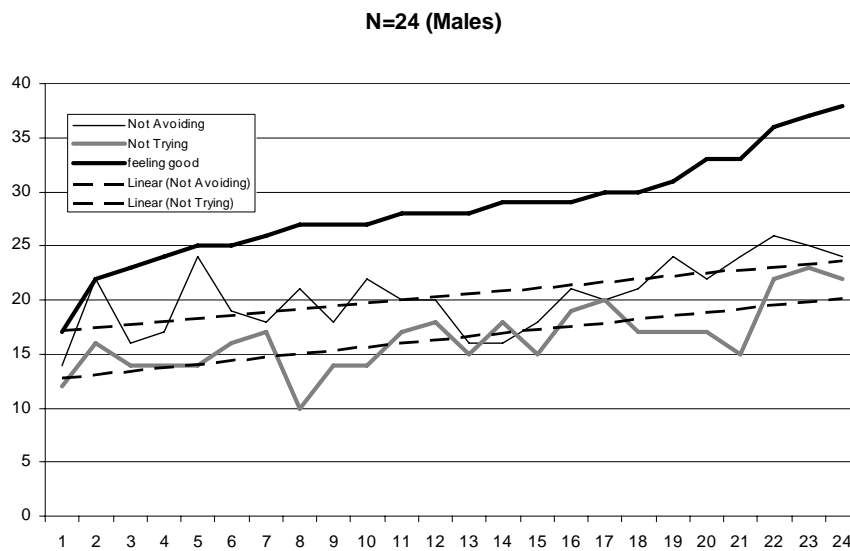
The N=21 correlated items from PQ-3 were isolated from the N=47 items from the PQ-2 questionnaires received. The results are indicated in Graphs 4 to 6 and suggest that again there was a tendency to gain a male dominated sample, thus the Overall and the Male only data and trends indicated in the tables were likely to be similar. As per Investigation Four, the Male and Overall data indicates very similar patterns and trends with the higher scores on the Feeling Good factor shown (thus they experienced high self-esteem), less Avoiding strategy is used but also the less Trying strategies were used. Again the male sample indicates

motivation problems and were only motivated to use active learning methods (the Trying Factor) when they felt poorly about their General, Social, Parental and Academic self-esteem (the Feeling Good Factor).

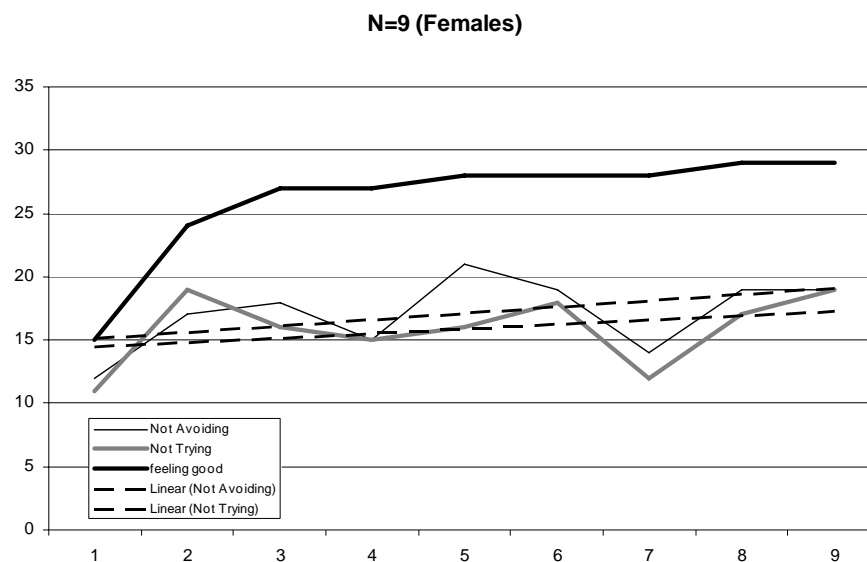
As found with the Pilot and Main study data, the females in the Birmingham and Enfield study did not have the same motivation problems as the males and this suggests a relationship that has been replicated. Looking at Graphs 4 to 6, we see the findings of the confirmation study replicating the gender differential of the use of the Not Trying or Not Avoiding factors. In the female graph there is an even greater use of the Not Avoiding factor (Emotional and avoidance-orientated coping).



Graph 4. Birmingham and Enfield data combined. Overall data, N=33.



Graph 5. Birmingham and Enfield data combined, Male data only, N=24.



Graph 6. Birmingham and Enfield data combined, Female data only, N=9.

Results – Age and Gender Data

The first results for Investigation Five looked at the overall data and gender breakdowns, investigations will now be made concerning age.

Table 23. Mean data for the Parental Questionnaire (PQ-3)

Sample	Gender	Age	N	Not Avoiding	Not Trying	Feeling Good
Pilot & Main Sample	All		26	20.7 (4)	14.7 (2.3)	28.7 (4.2)
	Males		17	21.5 (4.1)	14 (2.3)	29.3 (4.7)
	Females		9	19.3 (3.7)	16 (1.7)	27.7 (3.3)
Birmingham & Enfield	All		33	19.5 (3.4)	16.3 (3)	27.8 (4.8)
	Males		24	20 (3.4)	17.2 (3)	28.7 (4.8)
	Females		9	18.1 (3.4)	14.1 (1.8)	25.3 (3.7)
		Year 5	1	16 (0)	14 (0)	25 (0)
		Year 6	3	18.3 (5.6)	14 (3)	24 (7.9)
		Year 7	2	25 (1.4)	19.5 (3.5)	33.5 (3.5)
		Year 8	2	21 (0)	14.5 (6.4)	28 (1.4)
		Year 9	8	19.5 (2.6)	16.5 (1.8)	28.5 (1.9)
		Year 10	8	17.9 (2.4)	15.9 (2)	27.9 (2.7)
		Year 11	4	21 (3.4)	18.25 (4)	28.25 (6.8)
		Year 12	5	19.2 (4.6)	16.6 (3.8)	27 (7.6)
Birmingham & Enfield	Males	Year 5				
		Year 6	2	16.5 (6.4)	14 (4.2)	22.5 (10.6)
		Year 7	2	25 (1.4)	19.5 (3.5)	33.5 (3.5)
		Year 8	2	21 (19.7)	14.5 (6.3)	28 (1.4)

Table 23. (Continued).

<i>Sample</i>	<i>Gender</i>	<i>Age</i>	<i>N</i>	<i>Not Avoiding</i>	<i>Not Trying</i>	<i>Feeling Good</i>
		Year 9	6	19.7 (2.9)	16.7 (1.6)	28.8 (2.1)
		Year 10	6	18.5 (2.1)	16.7 (1.4)	27.7 (3.2)
		Year 11	3	22.3 (2.5)	19.7 (3.5)	29.7 (7.5)
		Year 12	3	19.3 (4.2)	19 (2.6)	31 (6.2)
<i>Birmingham & Enfield</i>	Females	Year 5	1	16	14	23
		Year 6	1	22	14	27
		Year 7				
		Year 8				
		Year 9	2	19 (1.4)	16 (2.8)	27.5 (0.7)
		Year 10	2	16 (2.8)	13.5 (2.1)	28.5 (0.7)
		Year 11	1	17	14	24
		Year 12	2	19 (7.1)	13 (1.4)	21 (5.7)

Discussion

The data indicated in Table 22 suggests that age is not a significant differential or variable when investigating trends, with such a sample or measure. Taking this sample as purely a confirmation study, Graphs 4-6 indicate that similar data has been identified that the overall and all males data (as both samples are male dominated) indicate that firstly those indicating lower general, social and parental self-esteem will avoid more (emotion and avoidance-orientated coping) and will be more focussed on task-orientated coping (learning from past experience), however when the self-esteem rises they are less motivated to avoid and more suprisingly, see less need for task-orientated coping. The tables also indicate in the female data, that low or high self-esteem has less impact on motivation and that the levels of trying and avoiding is insubstantial compared to their male counterparts. It is interesting that whilst the lower range of the Feeling Good factor is similar in both males and females, the high range is higher amongst the males, this may suggest that dyslexic teenage females experience lower highs to their self-image and have a lower self-concept of themselves.

Importantly, the data suggests that the frequency of the Not Avoiding and Not Trying factors are replicated, not only with overall but with gender differentials. The confirmation study indicates an even greater use of the Not Avoiding factor (higher use of Emotional-orientated and Avoidance-orientated coping) among a non-diagnosed sample, even with a higher Feeling Good (self-esteem) score. Such a higher use of an emotionally damaging strategy suggests that those struggling in school without diagnosis are more at risk of emotional damage.

Table 22 indicates the mean data, suggesting that the Pilot & Main study samples, and the Birmingham and Enfield studies are similar in overall, male and female sub group data. The Birmingham & Enfield results are slightly lower for the Not Avoiding and Feeling Good factor, indicating lower female scores. However in the Not Trying factor the female score is higher than the males, suggesting that there are differences between those with external (privately paid) educational psychologist diagnosed dyslexics or those diagnosed through the school, to those without any formal diagnosis. This would suggest that those lacking the

formal diagnosis are less motivated and do not believe in their abilities as much as those who have gained third party confirmation of their abilities (thus self-image may be a variable).

Conclusions

Investigation Five has investigated the parental questionnaire (PQ-3) with two different samples compared to the Pilot and Main studies, the results indicate that similar patterns of results are found and that this is evidence to the stability of the three factors (Not Avoiding, Not Trying and Feeling Good). The results indicate that gender again is a strong variable but analysis by age is not significant, however the small age defined samples can only suggest a trend rather than provide clear indications for generalized use.

CHAPTER DISCUSSION

The literature review investigated what dyslexia was, and how it affects dyslexics at school. It looked at the relationship between teachers and dyslexic children to understand current knowledge in the area. There are several studies that indicate that dyslexics suffer in the classroom. Many explain this is due to delayed identification or schools/teachers ignoring basic symptoms. Research suggests that the lack of teacher training has driven such problems and the UK government has only recently started to readdress this issue.

Investigations of any secondary manifestations (of being dyslexic) is a relatively new area for investigation and thus this study adds to the discussion by trying to make sense of the situation. This study aims to improve the lives of both the dyslexic that suffers, along with the lives of parents who are constantly pushing schools to assess their children but are being delayed through 'wait and see' policies and reduced special educational school budgets. Parents suffer as well, as they find the whole situation with their child stressful and they feel helpless in their ability to get their child assessed at school. The emotional cost of having an invisible disorder such as dyslexia cannot be underestimated, with cases of depression and attempted suicides beginning to emerge, as examples of the effect that dyslexia can bring. Alexander-Passe (2008c) suggests that a framework of 'Dyslexia Defence Mechanisms' as a means to understanding what is going on and to identify early symptoms of emotional suffering in dyslexics, before they turn into regressive or extreme manifestations.

Investigations One to Five have investigated a teenage dyslexic sample (N=26). The results and empirical evidence suggests that school-aged dyslexics are affected by their dyslexia at school and that they aim to deal with such difficulties by getting frustrated and angry. They cope with their difficulties by getting upset and blaming others or themselves, along with the avoidance of reading/writing tasks, rather than actively learning from past failure. They have poor perceptions of their abilities at school and to their peers. Data suggests that depression was more evident amongst the female compared to the male sub groups.

The parental questionnaire was seen as a means for parents to assess how their child copes as a reaction to their dyslexia, not only at school but socially, and from reactions to and from parents, peers and teachers towards their difficulties. Initially it was hypothesized that

avoidance would be a school-only phenomena, however the audio interviews suggest that avoidance also happens at home and that parents are in some cases adding to their child's school problems by not making home the much craved safe haven. The parental questionnaire was successfully validated against the standardised scores of their teenage children and three factors were isolated (Not Avoiding, Not Trying and Feeling Good). These suggest a framework which effectively describes how school-aged dyslexics cope. The analysis of trend data suggested that the motivational/self-esteem factor (Feeling Good) was independent to the two coping factors (Not Avoiding and Not Trying) and they in turn are independent of one another. Whilst this independence was less seen in males, in females the data suggests that the motivation to use the 'Not Trying' factor is not affected by the individuals use of the 'Feeling Good' factor.

The interview studies gave a snap shot of what it is like to be dyslexic. The resulting profile is one that suggests that they use avoidance, especially word and writing avoidance as a means to deal with school demands. Their avoidance whilst giving them the ability to progress through the school day, is in fact a form of camouflage and this is stopping their teachers seeing their dyslexia.

We also see how dyslexia affects every aspect of their school day (camouflaging is therefore delaying their diagnosis and paths to gaining the specialist support they so badly need). The interviews highlight that many dyslexics feel isolated and have few dyslexic friends. Without access to other dyslexics, they are only able to conclude that compared to their peers they are in fact abnormal. Access to other dyslexics can only lead to them seeing that their style of learning is just an alternative, and that they are not unique in finding school hard. It was encouraging that many of the interview participants enjoyed non-academic subjects and indeed many also excelled in these. Such success is important to boost their self-confidence, in a world where they constantly experience failure.

A male sample bias was found throughout the study, not only in the pilot and main study, but also the Birmingham and Enfield dyslexia association samples. There has been debate over the last decade concerning the higher instance of males being dyslexic. Researchers have noted that whilst the instance of dyslexia does not differ, the instance of identification does (Miles, Haslum and Wheeler, 1998), noting that whilst boys are generally identified more than girls (a 3: 1 ratio has been found from empirical studies) this has not come from an increased need, but rather from their different coping strategies at school, as also found in this study. Boys tend to cope by being loud, needy and attention-seeking in the classroom and thus their learning difficulties are likely to be seen, compared to girls who generally want to hide away or exclude themselves when they perceive themselves as abnormal. This strategy may allow them to cope with daily pressures in the classroom, but does them little good in letting others (e.g. teachers) know that there is a problem.

The gender differences found in this study reflects current stereotypical empirical data concerning what makes up male and female personality (Edley and Wetherell, 1995; Kilmartin, 1994) and their suggestions are indicated in Table 23. Social theories do not ascribe to a single meaning of maleness (Hearn, 1994) and Social constructivist theories of masculinity recognise that gender is achieved through and by people and their context (Stolenberg, 1989). Thus it could be argued that gender is not something we are, but something we do in social interactions. Studies of men with cancer (Moynihan, 1998; 2002) found that it was 'crucial for men to be controlled and silent about their emotional life...also the men needed to control when and where any emotion was shown'. They felt happier to cry

away from family, often in their cars where they felt 'enclosed and safe'. Male patients felt happier when male doctors referred to their illness on male terms (as machines, controllable and controlled) e.g. cases of testicle cancer 'a plane flying on one engine and landing safely.....one cylinder is as good as two' - holding their mind and body as separate and estranged. That said, men feel unable to cry in hospitals for sadness but are able to cry and hug team mates on the football pitch (Moynihan, 1998)

Whilst difficult, constructs of gender are possible in loose generic terms. Those indicated in this study are supported as within normal ranges. There have been very few personality studies that have specifically looked at dyslexics. Alexander-Passe (2008b) is one such study which investigated adult dyslexics (or those with high dyslexic traits) compared to non-dyslexic controls (or those with few or no dyslexic traits). Table 24 indicates how the dyslexic sample, sorted by gender compare, using Eysenck Personality Inventory sub-measures of Introversion vs. Extroversion and Emotional Instability vs. Adjustment and Introversion (Eysenck & Wilson 1995; Eysenck & Eysenck, 1975). As noted in the study, the profiles indicated for high trait dyslexic adults are interesting as not only do they describe dyslexic adults but researchers and educationalists will recognise many aspects of school-aged dyslexics. Thus the question must be asked, how much of this profile is developed in childhood? The literature review suggests that many of these emotional manifestations are commonly found in the secondary effects of dyslexia amongst school-aged children/teenagers (Alexander-Passe, 2006, 2008; Hales, 1994; Edwards, 1994; Riddick, 1994, Burden, 2005). So the development of the introverted dyslexic profile could very well start in childhood, and it could be suggested that their experiences at mandatory school, from interactions with both teachers and peers could be the cause.

Table 24. Gender Stereotypes

Masculine	Feminine
Inexpressive	Emotional
Aggressive	Expressive
Ambitious	Compassionate
Analytical	Childlike
Assertive	Gentle
Successful	Loyal
Competitive	Sensitive
Forceful	Tender
Independent	Understanding
Dominant	Yielding
Strong Personality	Gullible
Athletic	Refined
Invulnerable	Warm

Table 25. Gender data, dyslexic adults (high dyslexic traits) compared to control adults (low dyslexic traits)

Adult females with high dyslexic traits compared to controls Significant differences	Low self-opinion, feel unattractive failures Pessimistic, gloomy & can feel depressed Easily upset by things that go wrong Demand sympathetic attention
Adult females with high dyslexic traits compared to controls Major differences	Self-blaming, self-questioning of life Active & energetic Careless, late, unpredictable Have few special friends & enjoy solo activities
Adult Males with high dyslexic traits compared to controls Significant differences	Easily upset by things that go wrong Reliable, trustworthy, bit compulsive
Adult Males with high dyslexic traits compared to controls Major differences	Have a low self-opinion and feel unattractive failures Sentimental, volatile, sympathetic Active & energetic
Adult males and females (combined) with high dyslexic traits compared to controls Significant/major differences	A low self-opinion and feel unattractive failures Can be easily upset by things that go wrong Active & energetic

CHAPTER CONCLUSIONS

The overlying theme of this chapter has been that school-aged dyslexics are suffering in mainstream education, not only educationally but emotionally as well. The empirical data supports such a view and thus was the ground work for this study.

The standardised data points to dyslexic teenagers (12-18yrs old) using a range of strategies to deal with their difficulties and to safeguard their self-concept. Significant gender differences were found which suggests that dyslexics should not be taken as a single group and that male and female dyslexics react in different ways.

The data also suggests that males are likely to cope fairly well with their difficulties at school by learning from their errors (task-orientated coping) and thus progressing. Whilst their self-esteem is lower than average, their depression rating is low enough to suggest that they are emotionally stable. The interview data suggests they maintain their emotional stability through hobbies (mainly sport or music) and as many were found to excel in such hobbies to national level this suggests an alternative means to maintain their self-worth, along with a positive concept of what dyslexia was and how it might improve their lives.

Looking at the female data, it suggests that this group do not cope as well with their dyslexia. They are likely to use both emotional and avoidance strategies to deal with work demands, they may be seen internalizing (e.g. self-harm, over eating, not taking care of themselves) or externalizing their frustrations (e.g. taking it out on others, blaming others by use of violence or aggression towards them), along with avoidance of situations which might be uncomfortable (avoiding writing or meeting with friends when it demands too much on their literacy skills e.g. reading bus timetables or avoiding reading start times for films). Their self-esteem is much lower than the boys, which suggests they have a lower self perception of: themselves; their abilities at school; and their relationship with their peers and parents. A moderate depression rating suggests that they feel emotional damage as a secondary

manifestation of their dyslexia. Interview data suggests whilst they also excel in non-academic subjects (mainly art and music) they are more frustrated by the lack of support they get at school and at home. They also were more inhibited about their dyslexia compared to the male participants, suggesting that they have a negative concept of dyslexia, in fact one of the female participants even likened it to a social disease, which is reflected in many noting that their parents do not understand their dyslexia.

The study suggests that a means is required to easily assess coping strategies, and therefore this was the reason for the investigation which focussed on these coping strategies. Therefore an assessment measure. Parents were seen as the most capable in understanding their child, and had the time and motivation to take such a measure. More so than teachers or teenagers themselves, who either lack the time or ability to be unbiased.

Factor analysis was successful in identifying three factors from the standardised data drawn from the (N=26) dyslexic teenager sample. Two coping factors (names as: Trying, Avoiding) and one self-esteem factor (named as Feeling Good) were identified:

Trying: Dyslexic teenagers using the Trying factor use Task-orientated (learning from past attempts at work) coping resulting in high Academic Self-esteem (perceptions of their academic abilities) with negative ratings for Social Diversion (strategies to avoid socialising with peers to avoid situations that would rely on literacy) strategies and Depression (feeling low and helpless to help their situation).

Avoiding: Dyslexic teenagers using the avoiding factor use avoidance (avoiding tasks especially school work) and emotional orientated coping (self-blame or blaming others for their difficulties) along with Distraction (strategies to distract the self from correcting work) as a coping strategy.

Feeling Good: Dyslexic teenagers using the Feeling Good factor suggest that General (overall perception of self-worth), Parental (perceived relationship with parents and status at home) and Social (perceived relationship with peers) self-esteems are linked and are independent of the other two factors.

The experimental measure of N=47 was reduced to N=21 items through correlation to three identified factors (as noted above). The challenge was to identify how such a measure should be used and marked. It was decided to revert the two coping measures (now called: Not Trying and Not Avoiding) as some items were found in both the coping and self-esteem identifiers.

The results of the pilot and main study (N=26) sample was assessed through the N=21 item parental measure, it was found that the three factors were independent and that the 'Feeling Good' factor could also be seen as a measure of an individual's motivation. With the Trying factor it is interesting that there were gender differences when compared to the Feeling Good factor. The results from the female sample suggest that feeling good about their life (as noted in General, Social, Parental Academic and self-esteem) with the Feeling Good factor has little relationship to the effort they put in at school with learning, (as noted in the Not Trying factor) this is encouraging and suggests a good work ethic. It also suggests that they will put in the same level of effort to learn in good times and bad and they understand that this is part of life's ups and downs.

In the case of the male sample, the level of effort to learn (as noted in the Not Trying factor), has a minimal but positive relationship to feeling good about life, (as noted in the Feeling Good factor). The data suggests that when their General, Social and Parental self-esteem is high they feel less inclined to put in the effort to learn with tasks or at school. Such

laziness has also been noted in the literature and is not just confined to dyslexic males. This also has implications for motivation as with the female sample, motivation is not dependent on results, however with the dyslexic males there is more chance that this happens.

A wider Confirmation (N=33) sample was drawn from dyslexics (10-18yrs) in two areas of the UK (Birmingham and Enfield). This study had less rigid criteria for the volunteers (they were not required to give proof of diagnosis) and was aimed to capture dyslexics without formal diagnosis (e.g. privately through an educational psychologist) and who might also be struggling to get formal diagnosis in mainstream UK schools. The data suggests that the Pilot & Main study and the Confirmation sample data were similar in their overall male and female profiles. However, the confirmation results were slightly lower for the Not Avoiding and Feeling Good factor indicating lower female scores. However in the Not Trying factor the female score is higher than the males, suggesting that there are differences between externally (privately paid) educational psychologist diagnosed dyslexics and those without diagnosis. This could suggest that those lacking the external diagnosis are less motivated and do not believe in their abilities as much as those who have gained third party confirmation of their abilities and high I.Q. The confirmation study also looked at age as a variable, but no differences were identified.

The pilot and main results of the parental questionnaire were replicated in the confirmation study in that: (1) males used more task-orientated coping than emotional and avoidance-orientated coping; (2) When males had higher general, social and parental self-esteem they used less task-orientated coping (active learning), thus they had motivation issues; (3) females use similar frequencies of task, emotional and avoidance-orientated coping suggesting higher incidences of emotional damage amongst female dyslexics. It also suggests a lack of positive coping strategies in dealing with the frustrations that female dyslexics experience.

Overall, the Pilot and Main samples were successful in highlighting how dyslexics cope in mainstream UK schools. They suggest that the emotional effects of having a learning disorder such as dyslexia should be taken into account when dealing with their behaviour at school. Avoidance of tasks involving literacy must be seen as the defensive mechanism that it is, rather than laziness or a sign of low intelligence.

LIMITATIONS OF THE STUDY

With all studies there are limitations in how measures were chosen and how volunteers are handled. The following are the major limitations identified:

The N=26 Pilot and Main study was small in size and this may affect the stability of the results. Studies of hundreds of participants may shed light on other aspects of the dyslexic coping profile.

A larger sample might have highlighted different factors, as also found in comparing earlier analysis in (Alexander-Passe, 2006) of a smaller sample of dyslexic teenagers. The three factors were slightly different and found parents unable to identify the Avoidance factor.

The measures chosen were developed in relation to the empirical review and usage by other researchers in the field. There are various measures of self-esteem, coping and

depression, and these are screening rather than diagnostic in nature. Whilst they are respected validated measures, any conclusions must be taken with caution.

The parental questionnaire is experimental and thus there is no norm data to refer to. Items were chosen after reference to other measures and studies in the field.

All the studies were postal in nature and there is no actual confirmation the person named completed the questionnaires or took the audio interview. The researcher is confident that the participants who took part were those named on the educationalist report.

Dyslexics and parents of school-aged dyslexics are a highly motivated group and thus it was found that two types of individuals were attracted to the study: those with a private educational psychologist report (or able to afford the UK£200-300 fee for a private report) or those who pushed the school for formal assessment of their child.

It was stressed that there were no right or wrong answers in the test measures or audio interview. As the measures were complex to mark, it was felt that participants would have a difficulty prejudging answers.

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Chapter 2

**INTEREST AND MOTIVATION:
A CULTURAL-HISTORICAL AND DISCURSIVE
PSYCHOLOGICAL APPROACH**

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ABSTRACT

The theoretical concepts of (situational and individual) interest and motivation are of central importance to educational psychologists, because they denote phenomena that are said to mediate cognition and learning, and therefore individual development. In general, interest and motivation are approached predominantly from individualist cognitive perspectives, as entities or processes said to be embodied in the individual mental structure. The method, however, is not without its critics. Thus, the existing approaches to motivation can be seen as tools in the hands of the ruling class and therefore, psychology as a servant to the interests of this class. Whereas scholars may not agree with such analyses, the cultural-historical and sociocultural origins in the work of the Russian social and educational psychologist Lev Semenovich Vygotsky point us to other possible problems with individualist approaches to motivation and interest. According to Vygotsky, all higher mental functions have their origin in inter-human societal relations. That is, therefore, rather than studying forever-inaccessible structures of minds for the situational and individual interests a person develops and their relation to a person's motivations, a sociocultural and cultural-historical approach begins with studying societal relations generally and societal relations in which interests and motivations are (a) the topic of talk or (b) resources in the pursuit of other topics. This, then, leads us to the approach taken in discursive psychology, a relatively new discipline that already has made substantial contributions to the study of cognition generally and to the study of knowing and learning more specifically. In this chapter, we draw on an empirical study of career interests and motivations of high school biology students who were given the opportunity to participate in internship experiences in a university science laboratory. The scientists had offered these opportunities for the express purpose of increasing enrollments in the university's science faculty. Here we outline and exemplify a discursive approach to studying interest and motivation, which is an important and necessary perspective because participation in any human activity is always mediated

societally, culturally, and historically. We show how interest and motivation talk is produced and the intelligibility of such talk shared as cultural resource. We suggest that a discursive approach has significant possibilities for educational psychology, because ontogenetically, we learn what interest and emotion are in and through participation with others in conversations about interests and motivations. Therefore, interest and motivation are phenomena that for any individual are brought about in social interactions and discourse situations rather than phenomena that can be theorized as having their independent origin *within* the individual human being. We conclude with recommendations for a discursive approach to the study of interest and motivation that parallels a similar approach we take to “purely cognitive issues” such as conceptions and conceptual change.

INTRODUCTION

[T]he absence of academic motivation and lack of interest is also likely to be reflected in students’ neglect of their studies. Research over the last two decades has indicated that adolescents’ academic motivation declines over time. . . . Recent studies show that as children get older, their interests and attitudes toward school in general, and toward specific subject areas such as mathematics, art and science, tend to deteriorate. (Hidi & Harackiewicz, 2000, p. 151)

Interests and motivations have been a major field of studies for educational psychologists, as our introductory quote from a recent review of the literature shows. The field is of interest to all those who would like to increase academic performances and who recognize that there is little that can be done about innate abilities. In this field, interest is defined as an interactive relation between the individual learner and his or her environment—or aspects thereof including objects, events, and ideas (Krapp, 2002). Researchers do observe and theorize the structural and dynamic aspects of the phenomenon, but there appear to be few who question the very concepts of interests and motivations. Yet there are critical psychologists who, relating the field of psychology to cultural-historical development of society, show that the very phenomena of interests and motivations support ruling relations that attempt to make others (e.g., students) do what they do not normally want to do (Holzkamp-Osterkamp, 1975). Psychologists critical of their discipline in its more traditional form also show that psychological phenomena are not just *in* the individual as factors, characteristics, or innate structures. Rather, they recognize that “psychological categories that make up the mental thesaurus can be studied as a kitbag of resources for doing things” (Potter, 2005, p. 740). Thus, “beliefs,” “interests,” and “motivations” are part of a *discursive repertoire* that people in a variety of societal situations use to describe others or use to explain their actions: teachers frequently plan tasks that they believe to be motivating students to engage and therefore to learn.

The approach that discursive psychologists (e.g., Edwards & Potter, 1992) take to such topics of interests and motivations—psychological phenomena as practical, accountable, situated, discursive, embodied—is consistent with the cultural-historical approach to psychology, which is grounded on the premise that all higher-order psychological functions are concretely available in societal hierarchical relations between people (Vygotsky, 1978). It is precisely because of their public, intersubjective nature that interest and motivation can become subjective phenomena. In the course of growing up, children and adolescents learn to

talk about interests and motivations and to associate them with particular orientations and situations in their life, associated with particular bodily states (emotions, feelings). Yet we would not be able to identify the behavior of another person as angry without at first taking on our own affect-related sensations the perspectives of others, an outside perspective (Franck, 1981). Only under this condition can we ever associate the embodied behavior of others as indicating anger: the self-presentation of my own body is always intertwined with the representation of bodies and their states in talk. Just as talk about all other mental states—e.g., confusion, emotions, feelings—*interests* and *motivations* can be considered discursive resources for interacting with others in the pursuit of the overall motive of the particular activity at hand and in the pursuit of the goals that realize this motive. It therefore matters what the goals are, because we expect interest and motivation talk to differ if it occurs as part of one rather than another activity—e.g., a teacher talking to her students about their (career) interests or motivation studying science or interviews with students about this course. Because of the different goals to be realized in a science class or in an interview about learning science at school, the way in which linguistic resources are mobilized differ (Vološinov/Bakhtin, 1973).

The purpose of this chapter is to articulate a discursive approach to interests and motivations that is grounded in a cultural-historical activity theoretic framework that recognizes the public nature of all higher-order psychological functions in societal hierarchical relations. Because these relations are reproduced, sustained, and transformed in conversational situations, interests and motivations become available through the study of talk-in-interaction. Our study focuses on the patterned ways in which talk about phenomena is structured, as genres, with their particular plots and characters. More so, the social and material environment of the interview itself becomes a resource for communicating and talking about interests and motivations.

INTERESTS AND MOTIVATIONS AS RESOURCES IN INTERVIEW TALK ABOUT CAREER GOALS

The discursive psychological approach radically changes the way in which psychologists theorize the phenomena of interest to their field. Thus, instead of presupposing psychological phenomena as existing originally in individuals' minds and instead of treating language as a pathway to these phenomena in people's minds, discursive psychology invites us to rethink these prepositions by looking closely at the psychological discourses of and about topics such as interests and motivations. Why do discursive psychologists propose to rethink the role of interests and motivations as something in individuals' minds? What kinds of potential problems educational psychologists may encounter if they attribute interests and motivations to individuals by requesting participants to "answer" questionnaires or interview questions? In the following sections, we take an exemplary look at a series of interviews in which a researcher interested in the career goals and career planning interviews conducted with a number of high school science students; these examples allow us to articulate and discuss why and how discursive psychology approaches interest and motivation discourse differently.

“Accessing” Interests and Motivations

We may easily discern in society two different kinds of situations in which participants talk about interests and motivations. On the one hand there are the situations of everyday affairs, at work, at school, around the home, together with neighbors, and so on. On the other hand there are special situations such as (educational) psychology research, where researchers make interest and motivation a topic of their inquiries generally and the topic of their interviews or questionnaires specifically. It should be clear that the two are not inherently reflections of the respective other: Educational psychologists find the former situations and make them the topic of their inquiries; and they may seed the sociocultural landscape with new concepts that are taken up by members of society in general, who come to understand their lifeworlds in terms of these concepts. There immediately arises a potential problem from this relationship, as there may be mediations that are not normally acknowledged in research about interests and motivation. Thus, to make interest and motivation the topic of a research project and to interview students about their interests and motivations with respect to specific school subjects already takes a cultural and linguistic competence. This is true not only for the researcher but also for the research participants such that during an interview about interests and motivations, they each presuppose the intelligibility of their interest and motivation talk on the part of the other. We may therefore ask, what are the competencies that allow researchers and participants to engage in interest and motivation talk, and how do other aspects of the (interview) situation mediate this talk. In Fragment 1, we take a close look on a research interview concerning a high school student’s (Jennifer’s) career planning to observe how the interviewer and interviewee orient themselves into the interview situation. (Transcription conventions are described in the appendix.)

Fragment 1

- 01 J: ((Oriented toward others in the classroom, in exaggeration)) <<rall>its a my interview?>
 02 (5.32) ((Interviewer is getting ready))
 03: PL: kay i=m gonna take this ((takes a box with green and yellow sticky notes)) ((laughter)) i am
 gonna invite you to think about your future, any kind of possibility, about what you want to
 do, career, work, or jobs, and that kinds of things.
 04 J: okay?
 05 PL kay (.) and if you came out any idea ((takes out green sticky notes from the box and put them
 in front of Jennifer)) you could put one career or job (0.18) on each card
 06 J: okay.
 07 (0.38)
 08 PL: may (0.15) maybe you have some thoughts so you could write
 09 (0.30)
 10 J: okay
 11 PL: and here is a pen
 12 J: okay i only got one it involves biology kind of. actually i have two, you just want my career
 one then here then?
 13 PL: yes and not only biology but anything else.

Educators and educational psychologists analyzing interview frequently take the content of such interview text as representing a more or less fidele rendering of the thing (referent) that the content denotes. But taking such an approach leaves unaccounted for that the participants, here the interviewer and Jennifer, orient toward one another. They do so not only

to speak for one another, to spill words like beans from a pot, but to constitute the situation recognizable as such (figure 1), and with an eye and ear on possible responses and reactions. That is, the participants talk in the way they do so that after the fact they can legitimately say that they have realized an interview about interests and motivations; and they do so even in such cases where it is the first time they have participated in such an event. As all societal (inherently hierarchical) situations are characterized by the genres that are deemed to be appropriate *for the situation*, there is no indication why we should not begin with the presupposition that the interview is different from all other speech situations. That is, instead of presupposing that interest discourse in interviews mirrors peoples' interests in their everyday lifeworlds, we presuppose that people orient themselves differently in and for different situations. If the same genres are used across situations, this becomes an empirical matter rather than having to be presupposed.



Figure 1. The interviewer (left) and the participating student are seated in the back of a classroom, having previously agreed to meet for an interview to talk about the career interests of the latter. On the table, there are interview protocol sheets, a pen, a box full of green and yellow sticky notes, and a giant rolled paper brought by the interviewer.

In Fragment 1, we see how an interviewer and an interviewee (Jennifer) orient and transit themselves into an unusual event—a research interview about career goals. In turn 01, Jennifer acknowledges the special situation as she turns to her classmates in another part of the room by uttering “it’s a my interview.” Towards its end, the utterance becomes slower (see the transcription code “rall[entando]”) and the pitch rises, as would be characteristic for a question. The overall effect is that the comment stands out, but it does so in a refracted way, denoting the event as something out of the ordinary. That is, by means of intonation Jennifer produces a particular emotive-valuative attribution that marks this situation (figure 1) as different from what she normally does at this time of the day and in this place (a science classroom). She both participates and takes a reflexive stance to the interview about her life, career goals, interests, and motivations.

As the interviewer readies herself, Jennifer fully orients to this situation, in part mediated by the materials on the table, which mark out the physical arena of the interview context. The interviewer further orients the participant to this physical space by denoting and pointing to these materials (“gonna take this” [turn 03]) and then orienting the participant toward the content to be covered, which she denotes in terms of future jobs, careers, and related topics (turn 03). The two clearly define their roles as they go, as the interviewer makes statements

about what is going to happen, which are acknowledged as such in repeated utterance of “okay” (turns 04, 06, 10, and 12). In fact, it is in and through this contribution on the part of Jennifer that the interview can begin in this way, because other actions would set the stage in a different way and might even lead to termination. For example, if Jennifer were to say that she did not feel like doing the interview at that instant, it might be terminated right there and then. Readers may also think of survey researchers who, after having talked to a potential participant on the phone for a while, find themselves with a rejection to their request for participating in their research. Thus, together they co-start and co-produce the interview.

Toward the end of Fragment 1, following the different set up moves on the part of the interviewer, including her preparation of considerable stacks of sticky notes, Jennifer notes that she “only got one,” and “it involves biology kind of” (turn 13). Why would she have said that she “only” got one (career goal)? Whatever her private intentions, which we cannot speculate about unless she articulates them for the interviewer and therefore for the public generally as well, we can say that the “only” is heard against something else that is more, involves some quantity, which would not be required in her case. Jennifer’s answer here has to be read against what has happened *before* not after this particular instance, because neither she nor the interviewer could have known what would have been said only a few seconds hence, so that at any moment the future of the conversation is open, and any utterance is heard against and with respect to all preceding communicative acts. Here, the “only” can therefore be seen and heard in contrast to the stacks of sticky notes in front of her. The term “only” indicates that the physical environment Jennifer is in (e.g., an interview with stacks of sticky notes) already mediates this interest discourse.

Jennifer then offers a revised description that there were actually two (possibly interests), and then offers up a question, “you just want my career one then here then?” (turn 12). Here, we notice that Jennifer does not simply orient herself in an interview situation but also spends efforts to make sure that what she subsequently produces in the interview is what the interviewer “wants” (turn 12). In other words, the confirmative question shows what Jennifer produces later in the interview is not purely her own but already is negotiated with and oriented toward the interviewer. The interviewer reifies the offer (as question) by responding in the affirmative (“yes” [turn 13]) and then utters an invitation to extend the talk by talking about “anything else” not just about “biology” (turn 13). Thus, there is a request here that may have repercussions for the way in which the interview will unfold in that the participant’s utterances constrain the extent to which the talk about future goals can unfold—“only one, it involves biology” (turn 13)—and the interviewer’s offer to extend the talk to domains beyond biology. Therefore, we should be aware of the fact that interests and motivations “accessed” in research contexts such as interviews do not simply *reflect* interest and motivations in interviewees’ lifeworlds (like objects are reflected in a mirror) but are phenomena interwoven with other aspects of resources in interviews such as the presence (or absence) of the interviewer, questions, tools, and contexts.

Setting and Trajectory as Meaningful

Interviews take place in physical settings, which in their materiality, come to constitute ground for actions to be meaningful. Thus, the setting may be marked in particular ways and reference to these marked parts of the setting provides a background for the constitution of

sense. Because of this, participants in the situation do not have to track in their minds the interview content or rules of process because they can always find the marked elements in their surroundings; they do not even need to remember the pointers or markers, as suggested by a theory of situated cognition in terms of indexes that the mind keeps to things in the world (Barsalou, 1999). Rather, it is sufficient to remember that by looking around one can find relevant things that are part of the process of realizing the current activity, the interview about interests and motivations. Take the following situation where, after Jennifer has identified two interests on the available green sticky notes, the interviewer asks her to note some of her dislikes and provides the participant with another sticky note pack, this one of yellow color.

Fragment 2

- 01 PL: and this one were for your dislike ((figure 2a))
 02 J: ^okay.
 03 PL: ^okay.
 04 (0.60)
 05 J: just for biology or what?
 06 PL: no, anything,
 07 J: okay.
 08 J: your [disliking] and your [likes].
 [((places finger on yellow stack figure 2c))
 [((places finger on green stack))
 09 J: okay.
 10 PL: okay. not only biology

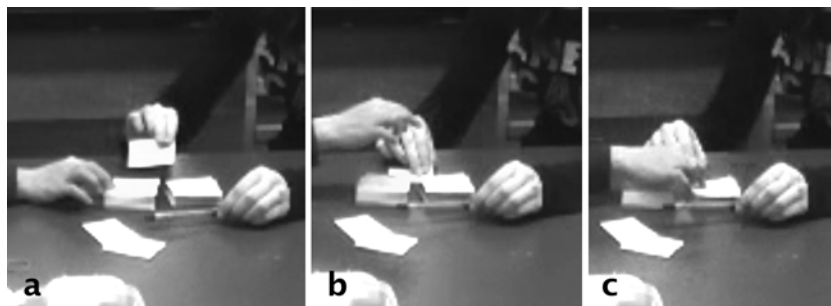


Figure 2. The interviewer, to the left, (a) points first to the pad with yellow sticky notes, then, (b) in a trajectory that takes her hand high above the notes, (c) comes to point to the other pad of sticky notes. The difference between likes and dislikes thereby comes to be physically and perceptually available.

In this situation, the physical space and some of the materials come to be marked in a particular way: here the yellows sticky notes come to be associated with dislikes, whereas the green sticky notes with the positive aspects of (Jennifer's) life. This is clearly evident from the events in Fragment 3 below, where the interviewer merely points to the yellow stack and, with rising intonation, which culturally competent speakers of English hear as a question, utters "and this one." Without any further clarification, Jennifer then immediately picks up the conversation following "this one" with talk about "dislikes."

Sense and meaning therefore cannot be sought solely in the words that are produced for the purpose of constructing an analyzable text that researchers subsequently use as data sources for their research. Rather, interviewers and interviewees both come to the interview

with resources (e.g., language) and produce resources (marked spaces, written text, mind maps, ephemeral talk) that subsequent talk and action take into account or as background against which the new talk becomes intelligible, meaningful, plausible, sensible, and so forth. Interview process, interview setting, and interview content thereby come to be closely, irremediably, and irreducibly intertwined: we cannot understand one without the other. Interview content, the text transcribed and attributed to the individual interviewee, here Jennifer, can be extracted only with a penalty: the text becomes literally decontextualized from the situation *for which* it has been produced and which only came into being because of the participants' speech actions.

The interview is a process that unfolds in time as it produces text. It is a situation often described as "laying a garden path in walking," because it simultaneously produces the text the production of which constitutes the intent of arranging and conducting the interview (process). Processes unfold in time so that what becomes available at a later stage takes into account and occurs on the evolutionary surfaces of what has happened before. Thus, once stacks of yellow and green sticky notes come to be marked in a special way, they can subsequently be remarked and re-marked. But the reverse is not possible. This temporal unfolding is not something generally taken into account in interest and motivation research, which assumes that the transcripts constitute a text that has the characteristics of a *written* text that exists in the present in its entirety, and which therefore can be studied like a coherent static system rather than as an unfolding process. This, however, is inconsistent with the cultural-historical approach that recognizes the developmental dimensions of thinking and speaking and the mutually constitutive relations between them (e.g., Vygotsky, 1986), a relation that constitutes the historical and contingent character of thought expressed in words at all time scales. Thought and word develop and mutually constitute one another on microgenetic, ontogenetic, and phylogenetic (cultural-historical) time scales. Because of this continuous development, what is said toward the end of the interview cannot be analyzed at the same level as what has been said at the beginning; rather, the latter is a developmental successor of the former, it is less articulated and articulate, underdeveloped, more general, and more abstract.

Emergent Phenomena

Educational psychologists generally assume that psychological phenomena they pursue exist as structures of students' minds. Thus, for example, those in the field who do research on science learning and scientific understanding may focus on *conceptions* and *conceptual change*. These conceptions are thought to be structures of the mind that are to be changed in and through teaching. But do students need to have extant cognitive structures to be able to talk about a phenomenon? There are studies showing that this is not the case and that people participate in conversations about phenomena that they have not thought about before (Roth, 2008). This is no different from talk about interests and motivations, as seen in the following fragment, where a student begins to talk about dislikes although she has not talked about them before as something salient in her thinking about her life goals generally and about her career goals specifically.

Fragment 3

- 01 PL: and [this one?
 [((points to a yellow sticky stack))
- 02 J: any dislikes? um not really still i guess as things come i will get more dislikes but at the moment i want to keep all my options open and try everything. right.

To invite Jennifer to address her dislikes (turn 01), the interviewer only uses the gesture (pointing to a yellow sticky stack) and indexical words (this one) and Jennifer recognizes that the person in front of her asks a question “(do you have) any dislike?” How can Jennifer articulate “this one” as “any dislike” without receiving a rejection from the interviewer? Here, the two develop a shared space, not only a social space but also, and literally so, a physical space, where different parts are marked in such a way that pointing to these places becomes a constitutive part in a meaning whole. That is, the interview has evolved into another stage where the meaning of gestures and colored sticky notes are shared and are ready to be drawn on as collective and intelligible resources. Also, in her turn, Jennifer utters with rising intonation, which we again hear as a query, “any dislikes?” (turn 02). We can hear this as a translation of the preceding communicative action, “and this one?,” that is, as an articulation of the sense in which the previous action was perceived (involving hearing and seeing). But this is not a simple translation of a question into another question, for the repetition of the same word—even if it were to be precisely the same word—would no longer have the same sense (Bakhtin, 1986). Here, the “any dislike?” can be heard simultaneously as articulating the sense in which it has been perceived and as a move that seeks confirmation whether this is what the offered query was about. Jennifer then, without pausing, launches into an utterance that will constitute the second part of a question–answer pair.

Jennifer comes to what turns out to be a temporary endpoint after having written notes on seven green sticky notes; she had not written at all on a yellow note. It is at this instance that the interviewer points to the yellow stack. After the events in Fragment 3, the interviewer provides more time for Jennifer to think (“you can take some time to think about it”) and then points again to the yellow stack; and it is only at this point that Jennifer notes, “so dislikes, um, tuitions may be.” She laughs, the interviewer utters “okay,” and Jennifer then notes on a yellow sticky “tuition fees & student loans relating to any post secondary education (I hope to get scholarship).” After repeated requests from the interviewer, Jennifer finally notes down “her” dislikes, though she had not noted any before. Why Jennifer did not note the dislike at the first place but produce it after being queried by the interviewer? Can we say that Jennifer “naturally” had dislikes? It was noticed that people can participate in conversations about things that they have never thought about before, and they do so in competent ways; they do so with the resources that the language and situation provides them with (Roth, Lee, & Hwang, 2008). Thus, children and students may talk about the relationship between the sun and the earth, stating, for example, that the former moves around the earth and pointing to the facts that the sun is rising in the morning and setting in the evening. In the same way that it would be dangerous to attribute cognitive frames and theories following such talk about the sun and earth, it would be dangerous to attribute dislikes to Jennifer in the context of life and career choices as if the dislikes were innate and facets of her character.

In the present episode, Jennifer did not speak about dislikes on her own—and even if she had done so it would have been for the recipient and anticipating her response, which is an

indication of the effect-dimension of the utterance.¹ Thus, we observe repeated offers by the interviewer to the interviewee to articulate dislikes. It is not that Jennifer does not *know* dislikes or has been unable to articulate them—she does so competently after repeatedly being solicited to do so. But in the first round, the production of the sticky notes, Jennifer does not write on a yellow sticky and therefore, does not articulate any dislikes. In the subsequent exchanges, both verbal and nonverbal, repeated offers were made for producing something that could subsequently be categorized as dislikes. Initially Jennifer states not to have any and wanting to keep her options open, but then, she offers possible candidates for the category: tuition fees and student loans. Can we say that the dislikes are merely an effect of the interview? The fact that Jennifer produces the utterance in which tuitions are the content grounds the fact of this particular dislike in her life and life conditions—a poor or working class student may not even consider going to university and a student from a wealthy home may not have to worry about tuition fees at all. Thus, the particular topic is best understood as arising from the dialectic of the structural constraints of the situation, the possible genres, language, etc., and the specific life conditions of this participant.

Fragment 3 also shows how participants provide one another with reasons for particular choices or decisions they make or positions they take—all communication is recipient designed, so that the audience becomes a *constitutive aspect of the determination of the genre itself* (Bakhtin/Medvedev, 1978). Thus, after articulating the sense of the question she heard, Jennifer initially states that she does not really have any dislikes (“um not really” [turn 02]). She then suggests that in the future she might develop more dislikes (school subjects?) but that at the moment “[she] want[s] to keep all [her] options open and try everything” (turn 02). Here she provides a rationale for not disliking (school subjects): it allows her to keep her (career?) options open. In this way, she can “try everything” and then make a (more informed?) decision about which subject matters she likes and which ones she does not. The rationale here is produced *for* the interviewer as a specific other, another person in particular, but she produces, in and through the use of language generally, a *culturally* possible rationale, that is, a *generally* intelligible and reasonable rationale. For the rationale to make sense to any specific and therefore generalized other, it inherently has to be part of the collective domain. Furthermore, when we look closely at the particular words Jennifer uses, “keep *all* my opinions open and try *everything*,” the terms of *all* and *everything* indicate extreme expressions that serve as *extreme-case formulations* (Pomerantz, 1986) as a persuasive way to legitimate her position (i.e., having few dislikes). If interviews were like windows onto minds, why would Jennifer spend any effort in using these extreme words to justify her position to the audience in the interview? The phenomena above all indicate that Jennifer’s rationale cannot be something merely singular and subjective; in being produced *for* the generalized other, from whom the language and its means and contents of expression have come to her, she concretely produces (realizes) and therefore reproduces a cultural possibility. Not only can interests and motivations be articulated in words—which makes the former inherently social and societal phenomena—but also human beings are predisposed to give reasons (grounds) for their interest-related and motivational predilections.

In this instance, the likes and dislikes are treated not in an absolute way but as constitutive of possible questions and answers with respect to careers. Thus, in the light of

¹ In technical terms, this effect is called the *perlocutionary* dimension of the speech act, of which the utterance (locution) and the speech intent (illocution) constitute the other moments.

talk about careers, Jennifer responds to the question about dislikes in terms of subject areas that she is taking in school. She does not yet have dispreferred areas, as this would diminish her career options. Thus, although she may have dislikes, in fact, many dislikes in life generally, the dislikes she talks about here, or absence thereof, are in respect to careers, career options, and having the widest possible range of actions. The possibilities that arise from such an open stance come to be articulated later in the interview:

Um and if I decide after my bachelor's of science major in biology that marine biology isn't the place I want to go. I come from I would go down to teaching and I would want to be a teacher of biology and pee-ee. . . . they are my favorite courses and I find that I wouldn't want to be teaching courses with provincial exams because I would rather teach something I wanted to teach rather than um teaching to lead up to an exam that I don't write. So um that was the main point of that. And I jus don't want to go into anything that has to do with becoming an English professor, or English teacher. I just don't want to go into English it wouldn't be fun at all.

In this situation, Jennifer and the interviewer have come together to conduct an interview about the former's career interests and goals, and about the different aspects of her life that motivate her choices and actions. As they have not done this before, and in fact, as it was the first time for Jennifer to participate in a research interview of this kind, the two initially also face the problem of how to act to make the conversation what it recognizably becomes: a research interview about interests and motivations. It is not so that both enter a box called "interview" and that this makes them act in ways appropriate for interviews; rather, the interview process develops out of the initial transactions not unlike the proverbial snowball becoming in the process of rolling and making the context for its own historical trajectory. To each interview there is a trajectory, where the participants evolve the parameters, the particular genre. This genre—here around the idea of doing an interview about the interests and motivations of high school students in a joint biology and career preparation course—like "every significant genre is complex system of means and methods for the conscious control and finalization of reality" (Bakhtin/Medvedev, 1978, p. 133). That is, what the reality outside the interview is and can be is a function of the particular genres that are admissible in and to an interview context.

Psychological Phenomena, Grounds for Action, and Accountability

One often-overlooked aspect of actions, interactions, and relations in educational context is the fact that human beings—here students, teachers, administrators—do not act and talk in a willy-nilly fashion, completely singular, and disconnected from the talk and actions of others. Because our own bodily states and perspectives are interlaced with the perspectives of others and with the language that we share (Franck, 1981), interests and motivations can be mobilized as rationales for actions and talk. Rather than being willy-nilly—i.e., groundless and without ground—all actions are such that people can provide reasons ("grounds") for them, deriving from the fact of the inherent accountability of (social) action. This accountability is precisely what allows human beings to attribute to one another intentions, motivations, and interests and what allows them to use intention, motivation, and interest talk for the purposes at hand: providing reasons for actions and dispositions.

The interview situation with its declared intent of talking about future goals also frames possible and intelligible forms of rationales. Thus, in the context of a conversation about future possibilities, life, life styles, and careers, it makes perfect sense to talk about keeping options open and to try a variety of courses to identify possible interests and careers, which then orient the establishment of goals that motivate what Jennifer will do—at the college or university—and how she will do them. This context shapes what future contents and genres the interview might take. Thus, interviews with factory workers in their late 50s might not at all bring up the topic of career options and dis/likes at all, for at that stage of life careers come to a close and dis/likes have formed; on the other hand, it might come up in conversations with university professors who decide to stay in their positions long after the previously mandatory retirement age of 65. The topic therefore mediates the genre and the genre mediates the nature of the topic. *This* interview therefore is mediated in its content by the particulars of Jennifer and the stage of life she is in. Both interviewer and interviewee are oriented toward that stage of life and produce a narrative account of career that is irremediably shaped by this orientation (Bakhtin/Medvedev, 1978).

In the end, the interviewer and Jennifer produce a two-dimensional array of the green- and yellow-colored sticky notes, standing for the likes and dislikes the latter had at the moment of the interview (figure 3). The representation takes the form of a mind map, in which the term “goals” constitutes the overall classifier, “careers” and “living status and lifestyle” denoting the next level of organization.

Here, then, the established and previously published interview protocol prospectively organized what the two were doing to produce sticky notes, which would then feature, as part of an organized structure, that is, as items on a mind map about goals. The interviewer who “follows” the protocol—developed by an educational and counseling psychologist who has done years of research in the area of career counseling—attempts in her utterances and actions to work toward a result such that in the end what has happened is a description of events that can be said to have realized and are consistent with the protocol. But whether this goal can be achieved is an empirical matter and in the practical situation requires the collusion of the interviewees who do not know the specific desired outcomes that have to be such that they constitute usable data in the researcher’s lab. (In university tenure committee meetings, for example, everybody knows what the expected outcome is so that all have an idea of what a correct procedure and final outcome is and therefore everybody can judge whether the goals have been achieved.) But the interviewee’s actions are required in the production of the interview as an interview, which adds to the event yet another moment of unpredictability. The map therefore is an unpredictable product co-produced in and through the interview as a whole instead of a predetermined copy from the interviewee’s mind. Thus, rather than treating interests and motivations as *inner* entities that drive behavior, we see the psychological phenomena as integral moment of discourse practices that are performed (rather than preformed) as resources to and products of interactions materially (externally) available to all.

It is in the same sense that we see “attitude” as constitutive of a set of heterogeneous evaluative practices that are used in different settings for different purposes rather than to see attitude as static in-the-head entities that are ready to be spilled onto Likert scales for psychologists (Potter, 1998). For instance, when people have made one or other comment (assessment) during a conversation, the respective interlocutor often simply articulates a

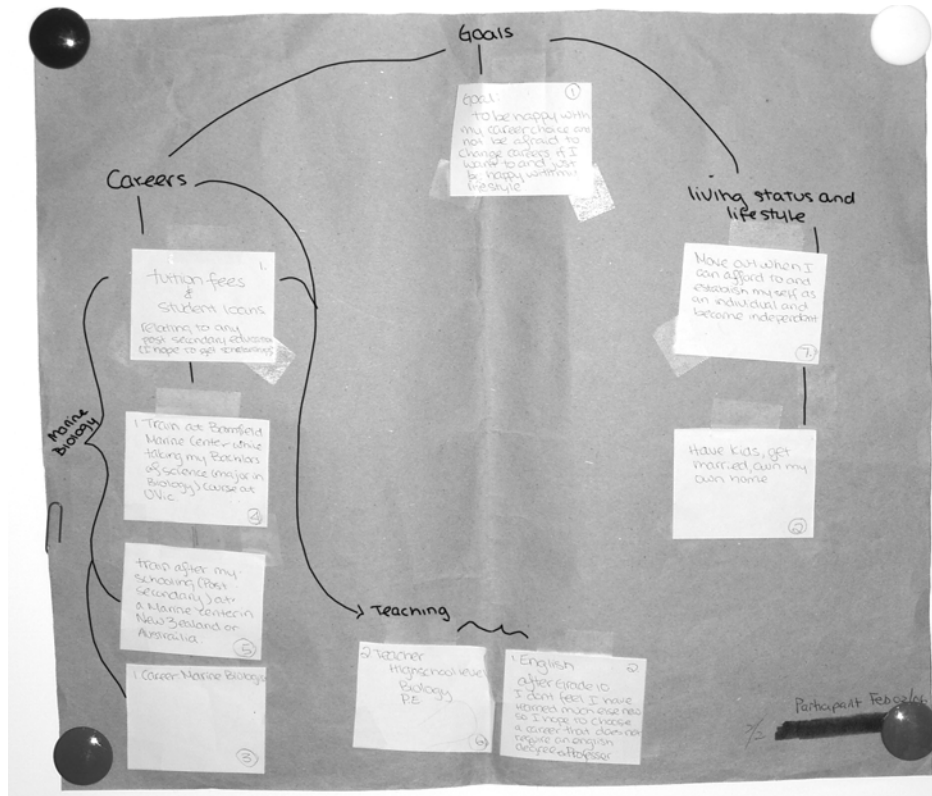


Figure 3. The two yellow-colored (right-most in bottom row, top-most in left column) and seven green-colored sticky notes are placed on a brown sheet of paper, hierarchically organized, linked, and subordinated to main concepts (goals, careers, living status and lifestyle, marine biology, teaching).

similar view in return (e.g., A: it is a great challenge, isn't it? B: yes, the challenge is terrific!). In the conversation, can we say that both A and B have positive attitudes? Does B really have a "natural positive attitude" or does he just avoid offending A (i.e., "attitude" is performed to achieve a social action)? Thus, to better understand psychological phenomena, we always have to take a conversational situation as a whole instead of simply attributing interests or attitudes to individuals. Moreover, how can it be that the interviewee produces a map that she has never produced before and also valuable for the interviewer? Are there not pre-existing cognitive frames or maps required for producing anything like a map? But this question becomes irrelevant when we think of the nature of the means interviewers and interviewees have available: The only means available to the interviews are the languages and genres that they are familiar with, which in the conversation with the interviewer, are constrained by the goal of achieving the interview as event and the interview text as outcome.

THE MODEL OF THE TEXT

To better appreciate and understand the relationship between interests and motivations as articulated in interviews and as aspects of individual/collective life, we draw on the literature concerned with the interpretation of texts (e.g., Ricœur, 1991). Texts refer to the world. In

spoken discourse, such as the interviews concerning interests and motivations in the present chapter, this means that what the dialogue ultimately refers to is the *situation* common to the interlocutors.

This situation in a way surrounds the dialogue, and its landmarks can all be shown by a gesture, by pointing a finger, or designated in an ostensive manner by the discourse itself through the oblique reference of those other indicators that are the demonstratives, the adverbs of time and place, and the tense of the verb. (Ricoeur, 1991, p. 148)

In oral discourse, therefore, reference is ostensive. We have already shown this irremediable feature of reference to the context when the interviewer, in Fragment 3, points to the yellow stack and Jennifer, without having to think about or interpret the gesture, understands it to be about dislikes. What research about interests and motivations tends to drop are all references and all possible signs to the interview as *event*; and such research subsequently retains only those aspects of the interview situation as a whole that are thought as *having been said*. In fact, the interview also, and collaboratively so, produces a text that is said to stand for something outside the text, the interests and motivations of high school students concerning life and career *in situations other than the interview*. This relation cannot ever be direct such that the interview text always is refracts the reality it is said to be about (Bakhtin/Medvedev, 1978). That is, whereas some of the text is directly concerned with its own production, other aspects of it are concerned with the production of a secondary text, the interview about interests and motivations. But this text concerning interests and motivations more or less will have to stand on its own, a text among other texts about interests and motivations, meaningful in its relations to all other, similar texts within this culture. Viewed in this way, the text (about interests and motivations) opens up references to the world as such, no longer tied to the local particulars, but rather realizing and articulating possibilities that exist at the cultural level as a whole. The attributions made in the interview texts are not free or belong to individuals, because individuals, to be understandable, have to fit certain culturally shared patterns of talking about them and the situations that they find themselves in. That is, these discursive patterns—i.e., genres—are about characters and plots. In this section, we provide examples for the constitutive nature of the interview context and process on the content of the interview, its topics, which in the present situation are interests and motivations. We subsequently articulate the textual nature of the recorded interview (transcript) and then turn to one of the consequences of interviews as texts: characters and plots as organizational features of talk about psychological phenomena.

Text Produces Context

Educational researches often only report people's "answers" from questionnaires or interviews without describing the contexts where people answer these questions. That is, they usually only report "expected (desired) data" whereas contextual descriptions of research such as present tools, researchers, environments, etc are normally ignored. However, different material contexts can in fact radically mediate people's discourse (e.g., Schoultz, Säljö, & Wyndhamn, 2001). We noticed in our interviews that the presence of tools on the table such as stacks of sticky notes and the product of map may mediate how interviewees articulate

their interests and motivations. As illustrated in Fragment 1, at the beginning of her interview Jennifer had fully oriented herself to the interview context (e.g., uttering the term “only” as to against stacks of sticky notes in front of her). The mediational effect of contexts is especially evident when we look closely at how interviewees make their notes on two different colored sticky stacks. For example, in Fragment 4, the interviewee (Mandy) has noted five dislikes on yellow sticky notes and then confirms with the interviewers that if it is okay to add an extra question mark on the fifth note “?clinical doctor MD.”

Fragment 4

- 01 M: can i put a question mark on this one? ((points to a yellow sticky inscribed with “?clinical doctor MD”)) because i=m not sure i want to do that, i dont [think
- 02 PL: [um ‘hmm
- 03 M: [i would.
- 04 PL: [um ‘hmm (5.27) so you: mean this one is between (1.06) both? ((fingers point to both yellow and green sticky stack))
- 05 M: yea that was kind of between both, like i am interested in medical (0.37) but i am not sure if i would want to work in like a clinic with just like (0.18) kind of the average like co:ld kind of (0.21) problems.

Mandy asks if she can to put a question mark on a yellow sticky written with “?clinical doctor MD,” because, as she formulates, she is not sure if she wants to be a clinical doctor (turn 01-03).² The interviewer first confirms Mandy’s question “um hmm,” and then, after a long pause (5.27 seconds), speculates “so you mean this one is between both” (turn 04) with her fingers pointing to the two stacks. Here, the interviewer responds to Mandy’s question as if she noticed that Mandy has difficulty categorizing the note “clinical doctor MD” into likes or dislikes. Mandy reifies the interviewer’s question “yea” and recaps her words “yea, it is kind of between both.” Further, Mandy provides more explanations about the action of adding a question mark. On the one hand, she wants to work in a medical context, but on the other hand, she is not sure if she wants to work in a clinic where she would be treating plane ordinary colds (turn 05). Therefore, adding a question mark on a yellow sticky note means that the written words are no longer *pure* dislikes but are something mixed, in *between*. Here, we notice that Mandy is concerned about dividing her choices into two opposite categories forced by the two differently colored sticky note stacks that the interviewer brought to the interview. That is, these differently colored sticky notes for interviewees such as Mandy are not regular and neutral papers but are marked with bias, as she recognizes that choices noted on a yellow sticky would be recognized afterwards as her negative interest. Fragment 4 therefore shows that these different colored sticky notes already presuppose a particular discourse that the interviewer and interviewee would use. That is, to talk about interests in a dichotomous and oppositive way that is consistent with the meaning carried by different colored sticky stacks. Otherwise, if the interviewee did not follow this category, she would need extra justifications such as Mandy’s question (“can I put a question mark?”) to mediate

² Here is one of the examples where we attribute uncertainty to the person. We do so because Mandy *formulates* why she asks a question, and thereby makes available the reason for asking this question. This situation is notable because in many situations human beings do not provide reasons for their questions and statements. From a methods perspective, this is another example of how we only work with whatever participants make available for one another, and therefore, for the analyst. We do not work with *inferred* thoughts, reasons, mental states, etc.

the production of misunderstanding. That is, the researcher's choice of using colored sticky notes prior to the interview already constrained and mediated the possible interest genres.

Mandy's question mark request also indicates that interviewees' interests in the natural and social world are quite different from interviews might otherwise illustrate. The fact that interviewees were invited to write whatever their likes and dislikes are appears to be a more open way of recruiting interviewees' statements (e.g., compared to questionnaires). However, these two categories already simplify and reduce complex forms of being-in-the-world into a binary category system and binaries may not organize our lives, shown by the way in which Mandy has difficulties fitting her predilections into a dichotomous category. Discursive psychologists have raised the question of the problematic reductionism existing in psychological research, which normally uses experiments, questionnaires, tests, or interviews to detect people's complex relationship with the natural world and then transforms and reduces data sources into factors or causes to explain peoples' behaviors (Edwards & Potter, 1992). It is dangerous therefore to reduce peoples' complex relationship with their lifeworlds to interpret individual differences or predict people's later actions. We must keep in mind that people in different situations have different cultural recourses to orientate their actions. Interest talk such as that employed in interview situations cannot simply *reflect* interests discourse in other contexts, because they have their own complex mechanisms of unfolding.

It can also be noticed that in the different stages of the interview, the sticky notes have mediated students' interest discourse in different ways. In the beginning stage of the interview, students produced a dichotomous discourse mediated by two colored sticky notes to articulate their interests and motivations. For instance, in Fragment 4, Mandy's question mark request for her fifth yellow note allows us to observe that she was oriented to follow this dichotomous category for her first four notes because she simply noted down without any special request. When students finished the map that required students to group likes and dislikes in terms of whatever reason would work for students. This ordering of the notes on their map transformed them into another function that in turn mediated students' interest talk. Thus, in Fragment 5, Mandy completes her map and starts to articulate her reasons for grouping different sticky notes.

Fragment 5

- 01 M: those three ((figure 4a)) are=um (0.33) all kind of biologically (0.99) related.
 02 PL: [um 'hmm (0.49) you dont like biology?
 03 M: NO I DO:: um
 04 PL: ((laughs))
 05 M: um just not that, like I have biology over here too. ((figure 4b))
 06 PL: ^okay.
 07 M: so i guess it just more like those ((figure 4c)) specific things in biology didnt really interest me.

Mandy points to a group of three yellow sticky notes (“?clinical doctor MD,” “Marine biology,” & “Vet”) at the corner of the map and explains that these three “are kind of



Figure 4. The interviewee, to the right, (a) points first to a group of three yellow sticky notes (biological related careers) to explain the group name “biology”, then, (b) points to a group of five green sticky notes (medical/health related careers) when she articulate that she do like biology. Finally, she comes to point back (c) to the three yellow sticky notes.

biologically related” (turn 01). In response to Mandy’s explanation, the interviewer then points to this group with her both hands and seeks clarification, “you don’t like biology?” (turn 02). Here, the words on the yellow sticky notes carry negative valence recognized by both participants. The interviewer therefore can reasonably ask the question “you don’t like biology?” in the situation. Mandy rejects this statement and ascertains that she in fact does like the subject (“no, I do” [turn 03]) in a louder voice than during previous talk, thereby making stand out—i.e., emphasizing, from Greek *phainesthai*, to appear—that she “does” like biology. After receiving the answer from Mandy, the interviewer slightly laughs as if there is a something unusual (turn 04). Mandy then points to another group of five green sticky notes (“Medical/medicine,” “doctors without borders,” “specialized doctor,” “W. H. O. world health organization,” and “Disease research/control”) located in the opposite corner of the map with utterances “like I have biology over here too” (turn 05) to point to what she has written on the green sticky notes biology-related careers—the ones that are marked as being positive interests. That is, these green sticky notes are her *evidence* that supports that she indeed likes biology. Then, Mandy’s hand points back to the group of three yellow sticky notes and justifies why she does not like all of biological related careers: “just those specific things in biology don’t really interest me” (turn 07).

Here again, the sticky notes mediate how the interviewer can ask a bi-valent question that makes sense to the interviewee. To respond to the question, Mandy draws on the available resources in front of her, the biology-related careers on green notes, to prove that she does like biology although she also writes the names of some biology-related careers on yellow sticky notes. That is, she uses the green sticky notes as a rationale to buttress her position. Hence the product of the interview, the map, has become a visual and communicative resource for both to make comparisons by pointing back and forth. Mandy’s actions show that not just narrative experiences in her lifeworld (e.g., family influences) may serve as rationales or resources to justify her interest, but these notes have evolved into another level that can serve as a different kind of rationale to justify a position. This is especially evident when the interviewer accepts Mandy’s justification “okay” without a pause (turn 06) as if these notes had indeed become shared discursive resources for both. This phenomenon supports the view that in the trajectory of the interview process, resources such as gestures or tools have developed a different sense and meaning for both the interviewer and interviewee (e.g., Fragment 2).

In this case, a tool available in the setting mediated both content and process of talk. This mediational effect may be drastic as shown by a study where the introduction of a globe into

an interview situation radically changed the conceptions children expressed and articulated about astronomical phenomena (Schoultz, Säljö, & Wyndhamn, 2001). Rather than talking about the earth as if it were a flat plane with the sun moving around it, the children showed how a rotating earth would receive sunlight on its different sides. That is, the physical resources at hand closely mediated the topics of research studies. This phenomenon then leads us to question: “If interests, motivations or conceptions belong to individuals, why would psychological phenomena radically change just by entering an artifact into the interview context?” To better understand interests or motivations discourses, we therefore must not attribute the psychological phenomena solely to individuals because the interests reported from research interviews are the interviewee’s and not the interviewer’s at the same time. It is the same in Jennifer’s case, the very structure of the representation that the two develop as Jennifer’s life goals (figure 3) is a product of the interview and therefore cannot be reduced to the mind and personality of Jennifer; nor can it be reduced to the interview protocol.

Context Produces (the Interview) Text

As the interviewer and interviewee collude they produce both the interview as a situation and the recorded interview as a text. This text reflects both the content of the conversation (i.e., the text about students’ interests and motivations) and the continual work required to make this situation an interview (i.e., the text that makes the *context*). If this additional work were not done, mutual alignment could not occur and the desired content, and interview about interests and motivations, would not be captured in and by the text. The text therefore refers us to two situations, the one in which it was produced—i.e., the *context*—and the one that some of the textual content is said to refer to. Furthermore, the text that results from the interview process is material through and through. It becomes a data source precisely because of this material nature. But this material nature also constitutes and subtends its ideological nature. The first principle from which “the study of ideology must proceed is the principle of the material and completely objective nature of ideological creation as a whole. Ideology exists completely in the external, objective world and is completely accessible to a unified and essentially objective method of cognition and study” (Bakhtin/Medvedev, 1978, p. 8). From a cultural-historical, discursive perspective ideological products and the ideal meanings associated with them are not to be searched and found within a person, sequestered underneath the skin that is said to constitute the divide between the inside and the outside, the intrapsychological and the interpsychological. Meanings are “not in the soul, not in the inner world, and not in the detached world of ideas and pure thoughts, but in the objectively accessible ideological material—in the word, in sound, in gesture, in the combination of masses, lines, colors, living bodies, and so on” (p. 8). The relationship between the text and the lifeworld of the interviewees therefore cannot be simple (i.e., a reflection), if not for the simple reason that the two pertain to two different but different yet connected parts within the unity of social life.

In this regard, the social connections which implement meaning are also varied. That is, the aggregates of all the actions and interactions elicited and organized by ideological meaning are also different. This explains the various relationships of ideologies to the

surrounding reality and the special laws for the refraction of reality that are proper to each ideology. (p. 12)

In this quote, the authors point out the differences in the meaning of ideological materials—including words, sounds, and gestures—when the situation is changed, which for these authors included the fullness of concrete material life and the same life as depicted in written materials. The interview text cannot be understood outside the unity of the situation that produced it, and its relations to other parts of social life therefore have to be empirical matters.

The interview is meaningful in its entirety. The very construction of the auto/biographical text that results from the interview process is the motive that makes the interview meaningful as event. More so, the object in itself has to be intelligible, constituting a narrative of someone's interests and motivations has to be intelligible *as* a motive for the interview about interests and motivations to make sense. This motive, however, does not come from either *this* interviewer or *this* (these) interviewee(s). Rather, it is something that already exists as possibility at the collective level; and it has been realized as such by others. Even when the very first social scientist began to conduct research into the interests and motivations, the object/motive of his or her research already had to be a possibility, both intelligible and accountable in terms of familiar genres and repertoires.

To truly understand the interview text, we therefore must seek to understand it from the inside, the laws of its production in and through the interview situation, the narrative possibilities of language and associated culture, the particulars of participants (age, race, culture, gender), and their life stages. That is, we must take an *emic* approach that understands psychological phenomena in and through participants' dispositions and practices rather than an *etic* approach that is aimed to interpret psychological phenomena in terms of outsiders' theories or accounts.³ More so, other than a written text, the transcribed interview about a topic of interest—here interests and motivations—needs to be understood from the perspective of a first-time-through event, because the participants did not and could not know the landscape of the content that the entire interview would produce and cover. Thus, even if the participants returned to issues already talked about to elaborate, deepen, verify, and ascertain what has been said, the interview text could not be understood as the result of some stable character or protagonist—in our examples, Jennifer—who makes available some stable and (at least momentarily) unchangeable core of herself. On the contrary, we see these stable patterns as cultural and familiar resources that participants may take for granted in their conversations.

In the present situation, the inner laws include those of the production of a coherent narrative about interests and motivations, which includes intelligible ways of accounting for social actors and events. Thus, interviewers will not just ask *any kind* of question, but instead ask questions that aim at the production of a *coherent* account of the life and career interests of students such as Jennifer and Mandy (e.g., a bi-valent question about interests in Fragment 5). The two students, as everyone else participating in this aspect of our research, contribute to this motive of producing intelligible accounts of their lives and visions of their futures, which are made plausible *because* of the interest and motivation concepts that the speakers

³ The terms *emic* and *etic* are common method-related notions in anthropology to distinguish, respectively, insider perspectives from outsider perspectives on a culture.

mobilize in support of their goals. Thus, for Jennifer the goal is a life independent of her family and the creation of her own family. Getting a job that meets her interests in marine environments, their fauna and flora, provides a narrative coherence that is plausible to listeners in general (interviewer, analysts, our research group). That is, it is not just any talk that achieves the interview about interests and motivations, but the interview as process is intertwined with the particular object/motive of and for the process: a text that has an internal coherence telling a life, life goals, interests and motivations in an intelligible and plausible way. The interview, as process, is oriented toward and organized by the production of an intelligible narrative about interests and motivations; and the narratives about interests and motivations are oriented toward making the interview a successful societal activity. The production of each mediates the production of the other. That is, the interview is not unlike the situation in which novelists find themselves: producing texts that have narrative coherence because of the mutual conjunction, coordination, and articulation of specific characters and specific plots.

Characters and Plots: Constraints on Possible Life Narratives

In everyday culture we articulate human lives generally and our own lives particularly in terms of characters and plots (Roth, 2007). Who we are and what kinds of situations we find ourselves in become intelligible because characters and plots are cultural possibilities that are realized in different but intelligible ways. Plots provide for narrative coherence and constitute “a synthesis of the heterogeneous, in order to speak of the coordination between multiple events, or between causes, intentions, and also accidents within a single meaningful unity. The plot is the literary form of this coordination” (Ricoeur, 2004, p. 243). Plots are filled with characters, a term that denotes both a type of being and the set of lasting dispositions by which a person is recognized. It is because of the notion of character that individual identities come to be stabilized. Thus, “[b]y means of this stability, borrowed from acquired habits and identifications—in other words from dispositions—character assures at one numerical identity, qualitative identity, uninterrupted continuity across change, and finally, permanence in time which defines sameness” (Ricoeur, 1992, p. 122). Auto/biographies are intelligible and plausible because of the intelligibility of the narrative cohesion of plots (dangerous encounters, favorite situations, familial relations) and characters (heroes, underdogs, good samaritarians). These plots employ specific *chronotopes*—literally time-spaces—such as the family/home, encounters, life course and career (Bakhtin, 1981); and it is through the cultural-historical (shared) nature of these text-internal chronotopes that auto/biographies in turn are shared.

The character and plot—and everything else that comes with narratives including the genres, expressions, structural possibilities, and chronotopes—are constrained by and a constitutive moment of the interview. As objects of the intention for the interview, we no longer think the contents—i.e., interests and motivations—as something lying outside the system of the means of representations, the unfolding interview and the material traces it leaves in the mechanical record and its subsequent transformations. “Content necessarily has a constructive function within the closed unity of the work, the same function as all the other elements conditionally united in the concept of form” (Bakhtin/Medvedev, 1978, p. 48). Interests and motivations, as content, have a constructive function within the closed unity of

the interview, which will be appreciated in a positive manner—i.e., as successful—precisely when they fulfill particular narrative functions in the overall constitution of the life and work of the research participant.

Plots and characters are not singular phenomena but inherently societal and linguistic resources that are intelligible and plausible for *all* conversation participants in any concrete situation. This is so because to make something anticipated in the research design as an interview about interests, motivations, career, and life possibilities, both parties to the event have to collude. And this collusion presupposes intersubjectivity. In part, this collusion involves the production of utterances that reproduce their respective roles as interviewer and interviewee, with their anticipated division of labor, according to which the interviewer asks questions and the interviewee responds to them. But the making of these interviews in the anticipated ways also requires the content to take the anticipated form, drawing on familiar chronotopes, plots, and characters. And because participants always talk for the other, anticipating their responses in their utterances and taking into account what they and others have said before, what is being said has to fall into specific genres. The languages used as part of these genres, their possibilities, and their forms are ideological, societal hierarchical through and through (Vološinov/Bakhtin, 1973). Thus, for Jennifer the overall organization of the plans for her future is to be successful, and this means a specific form of life: “I wanna be successful and in my mind it is moving out and becoming an individual, getting married, having kids, and living on my own,” a typical middle-class genre about life after leaving the birth family. To be intelligible, it does not suffice that the recipient of the talk is familiar with the English language and knows the 25 words in the utterance. It does not suffice to know at least implicitly English grammar to understand the relations between the different words, the clauses, the subject and predicate. What is required in addition are the relations between plot and character of the person being talked about, which here is one of the participants. That is, to better understand what the interview text provides us with we need to render the situation stranger than it normally is, as a situation analogous to the writing of novels and stories, that is, to the production of narrative forms (genres).

The interview can be understood in a way similar to the act of writing a story and the recorded (and transcribed) interview constitutes the final text. The relation that this text has with the remainder of the culture generally and to the life of the individual particularly is not simple and linear. In fact, it relates to material and economic life in a way similar to that of the character and plot of a novel to the life outside it. (It is for this very reason that psychoanalysis and Alcoholics Anonymous function as re-orderings and new understandings of life through the reorganization of life narratives, in which case there is a mediation of external chronotopes by text-internal internal chronotopes.) Thus, when Jennifer talks about her plans, she accounts of herself in terms of a character that fits into specific culturally enabled plots, and both character and plot have to take intelligible and meaningful content and form. In the following, Jennifer talks about training at the marine station in Bamfield, wanting to do a bachelor of science, majoring in biology at the local university, doing post-secondary training in New Zealand or Australia (popular in the area where the research was conducted because of the cultural similarities between Canada and the other countries). Here, the chronotope is “the life course of becoming a marine biologist,” which comes with specific places, trials and tribulations, and courses and programs to be followed. She does not merely envision or want to make these already and inherently intelligible choices, but she also has grounds for these choices, which also are intelligible and meaningful in the context of the

particular chronotope. Thus, going to train at the Bamfield marine center (Canada) and to pursue subsequent training in similar centers in New Zealand and Australia “would give [her] more experience.” And this experience is necessary to “lead up to becoming a marine biologist.”

Okay well I put them together because they all have career aspects to them like training at Bamfield and I want to take bachelor or science, major in biology at u-vic and that leads up to after I do my schooling I would do my post-secondary training at some center in either New Zealand or Australia. And that would give me more experience. I would probably have to get my PhD as well to do that. And that would all lead up to becoming a marine biologist and hopefully I would be hired by one of the two places I would be training at.

Here, Jennifer repeats a plot pattern related to a professional personnel training situation (“training at Bamfield” & “training at some center in either New Zealand or Australia”) and its similar characters (“[people who] major in biology” & “a marine biologist”). That is, the plot of training personnel allows Jennifer fitting herself into its storyline and relative characters; at the same time, it allows Jennifer to use the cultural plot for communicating her interests to the interviewer. Again, and especially in an increasingly globalizing world, we need to keep in mind that a genre is specific to a culture and its ideology, and that a story line that makes sense does not necessarily make sense if the narrative were to be translated into another language such as Japanese. This is so because genres and chronotopes are culturally specific, and the genres and chronotopes for constituting life histories are no different (e.g., Roth, 2005).

The particular life choices arise from the life and experiences of participants. These, in turn, provide intelligible grounds for explaining choices, interests, and motivations. Thus, when the interviewer asks Jennifer why marine biology is her primary choice, Jennifer responds:

I guess because I have grown up on the coast and have always been at the beach and stuff and I just think it is cool because it is a whole different world the marine life. It is so different from land life but at the same time it has a lot in common. I think especially because there is a lot more we don't know about marine life.

In this situation, Jennifer draws on a particular repertoire, experiences during childhood as determinants of subsequent career choices and trajectories. This repertoire is a common one for telling auto/biographies in the sciences, both in the positive sense that parents influenced or supported choices and in the negative sense that some career was pursued despite the resistance on the part of the family or some of its members (Lee & Roth, 2004). This (cultural) repertoire within the chronotope of the family, which specifies members of the family as (causal, mediational) influences on (emerging, existing) interests, is also evident in the following excerpt.

I mean my mom is a nurse and with her whole family we have always been very biological, we have like biology in the family, nurses and doctors. It's just been kind a family thing that has been passing down. So because of my mom I learn a lot of stuff about biology, like human biology and animal biology because she grew up on the coast as well. So she was constantly interacting with the field and my grandparent have a

waterfront house. So we have been down there looking at the ocean and stuff. So we have come to learn about a lot of that stuff through common sense and I guess she just really got me started on that. And because she is a nurse I know so much about nursing that she has just taught me over the years.

Here, growing up near the ocean, having grandparents with a waterfront home, having a mother who has grown up near the ocean all pertain to a narrative repertoire that makes having interest in marine biology intelligible and plausible (reasonable). It is not something that is particular to Jennifer, but rather, as a repertoire and possible plot, constitutes an inherently plausible trajectory (a constitutive moment of the chronotope *life course*) for her own character in a plot that she currently narrates for the researcher.

Other experiences that are both intelligible and “good” reasons for explaining interests and motivations derive from experiences, themselves accounted for in the admissible languages and genres of the situation. Thus, Jennifer uses the account of a field experience in the nearby, world-renowned marine station (Bamfield) as mediating her interests and motivations,

I absolutely loved it, last summer I was really upset when I had to go home. The first day I got home I just sat around and moped all day. I missed it so much. And I guess I thought it was such a good experience it so many ways. I learned so much from Bamfield that it really inspired me to become a marine biologist and to see what they were all doing around there, they were all just, it was just so cool because they all loved biology. I felt really accepted there because they all did, they like the same thing I do so it was just really cool.

This experience “really enhanced” her interest in becoming marine biologist, from initially being something that might be “really cool” to becoming something describable by “I was like, I *want* to be a marine biologist.”

I guess Bamfield really enhanced it and I really really wanted to before that so I wasn't really sure if that was a good field for me but after being at Bamfield, being in biology, being in science ten I got really really interested in it and it was a good introduction for me. So I started to realize that there is a lot more I don't know about the ocean and I would really like to find out about it. So I decided that that that was maybe the way I wanted to go. So I find it really interesting I watch movies about it I look on the Internet about it. It just boggles my mind.

The idea of *choices* inherently comes with alternatives among which selections can be made, and these alternatives are as intelligible and meaningful generally as the main goals—it would not make sense to say something unless it can be presupposed to make sense and to be intelligible to the other, which inherently means not just one other but in fact the generalized other. This precise point is salient in the interview with Jennifer, who, at one point, reiterates the goal to be independent from but linked to her family; and part of being on her own is having a family, “have kids, and do the whole married thing.” In this situation, “doing the whole married thing” makes thematic the cultural dimensions of having a baby and getting married: it is a thing, a generally understood pattern, that young (middle-class) people enact and become involved in at a particular stage in life, and which they may include among their aspirations at an earlier point in time. This pattern is itself cultural and historical, as the

members of the “flower power” generation often did not get married but had children nevertheless (sometimes with very unusual first names such as “Moon Unit”).

Having the possibility of choice itself is part of a Western life trajectory (i.e., the life course chronotope), where the protagonist character goes down one path but leaves open another: “I just want to be happy with my career choice and I don’t want to feel stuck in my career cause I can always change cause I have two lined up here. And I just want to be happy with my lifestyle. Make sure that, I guess my main goal would be overall happiness.” In other cultures and at different societal hierarchical levels, choice may not be a relevant discursive repertoire and part of a life narrative, especially in cultures where girls and young women are subject to pre-arranged marriages but also in Western culture when individuals say that they had done this or that because (one of) their parents had said so. That is, depending on culture and life stage, the chronotope *family* is different and has a different topology, different gradations and graduations, but always remains intelligible within the particular cultural-historical context. In the cultural-historical context in which Jennifer lives, however, it is intelligible and plausible to talk about choice. Thus, when pressed, Jennifer states that the two choices she envisions at the moment, biologist and teacher, are but initial choices and that there may be other interests cropping up in the future, such as going into medicine, but even in this instance, the chosen career path should “have to do with either biology or teaching.”

These are my two main but I think if I had a long time to think about it and put my mind to it. I’ve been told to be a teacher since elementary school and marine biology I have been thinking about for years too. I guess this is all I have gotten so far. I guess if I didn’t go into this it would probably be some branch of teaching or biology in some way. So if I decide to go into more medicine I could do that. But it would definitely have to do with either biology or teaching.

Here, too, the repertoire of influences in or since childhood is mobilized to account for the particular interests and motivations Jennifer now articulates as orienting her life. In summary, therefore, interviewers and interviewees are bound by constraints by what they can say without transgressing the boundaries of the particular situation, in the present instance, an interview about goals, interests, and motivations. In the literature, it is commonly not assumed and not even made thematic that such interviews are achievements that require the collaboration and collusion of all participants. This very collusion leads to the fact that the work of making the interview as a recorded product becomes invisible. That it is actually an achievement is revealed when interviews turn out to be something different, unanticipated by the researcher who designed the experiment. Thus in one instance in one instance that we reported, the research assistant was instructed to invited scientists to sessions the purpose of which was to produce think-aloud protocols of experts that might serve for the subsequent design of high school curriculum (Roth & Middleton, 2006). As we reported, however, mediated by the insistent and persistent attempts of some participants, the interviewer began providing answers and feedback, allowing the think-aloud protocol to turn into a tutoring session. Again, it took both types of participants, research assistant and participants, to coproduce the event and its historical trajectory to become something other than the research design had anticipated.

The Interview as Text-Producing Self-Re/Producing Context

The present analyses exhibit how the interview is a special situation, one among the many that make society and the world in the way we know it. Interviews are part of our cultural landscape (figure 5), and, in their contributions to particular systems of activity (e.g., educational research), contribute in more or less direct way to the production and reproduction of society. Our everyday knowledgeability is an important resource for making the interview into what it is (figure 5, broken arrow). The interview is a cultural-historical phenomenon, the external chronotope with respect to the narrative about the life, interests, and motivations of our student participants. The talk not only produces text about the topic but constitutes the very situation. As other societal situation, interviews require the collusion, collaboration, and mutual orientation of the participants. This “mutual orientation of people defines each act of cognition, and the more complex, differentiated, and organized this mutual orientation is, the deeper and more important is the resulting comprehension” (Bakhtin/Medvedev, 1978, p.13). In the context of the present chapter, the person in the world generally and her interests and motivations more specifically (figure 5, solid arrow) constitute the contents of the interview (figure 5, parabolic funnel), the intention of which is to produce a text from which students’ career interests and motivations are to be constructed as social-psychological phenomena (figure 5). This text itself becomes part of society in that it constitutes the data from which educational psychologists reconstruct interests and motivations.

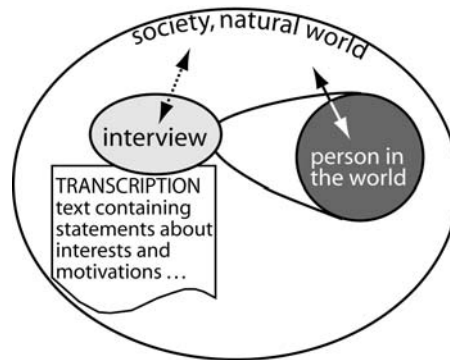


Figure 5. The relationship of interview to its object, the person in the world, her interests and motivations, and the constitutive relations between interview and world.

The interview constitutes an ideological environment, and as all ideological environments, constitutes the “realized, materialized, externally expressed social consciousness [of the thereby] given collective” (p. 14). Here, the social consciousness cannot be understood independent of the individual consciousness in the same way that the social consciousness cannot be understood independent of the individual consciousness (in itself a form of social consciousness [Franck, 1981]) that implements and realizes it. Thus, “the individual consciousness can become a consciousness only by being realized in the forms of the ideological environment proper to it: in language, in conventionalized gesture, in artistic image, in myth, and so on” (Bakhtin/Medvedev, 1978, p. 14). This ideological environment is in a constant dialectical process of generation such that “every act of his consciousness and

all the concrete forms of [man's] conduct outside work . . . are immediately oriented in the ideological environment, are determined by it, and in turn determine it, while only obliquely reflecting and refracting socio-economic and natural existence" (p. 14). That is, what is said in the interview (the internal chronotopes) cannot be understood as the (linear, photographic, mirrored) image of the interviewees' lifeworlds, including their interests and motivations (the external chronotopes), but rather reflect the social reality only in some oblique, refracted, and ideologically mediated way.

The complex relations between society as a whole and one of its constitutive parts was articulated, with respect to the arts, by Bakhtin/Medvedev (1978), who warned researchers of the dangers that breaking out particular human pursuits and regarding them as in some ways independent of the world as a whole.

The work cannot be understood outside the unity of literature. But this whole unity and the individual works which are its elements cannot be understood outside the unity of ideological life. And this last unity, whether it is taken as a whole or as separate elements, cannot be studied outside the unified socioeconomic laws of development. (p. 27)

In the process, the arts, research interviewing, or any other special pursuit in a constitutive relation with socioeconomic life as a whole do not lose their individualities. To the contrary, individuality of some pursuit, research and interviewing, can be completely discovered and understood only in and through the transactional processes. We must not forget the double relation linking the interview and the ideological environment in that the latter (figure 5, solid arrow), in and through the person in the world, becomes the content of the former (figure 5, broken arrow), and it is the former that constitutes part of the societal and natural world.

In educational and psychological research, as in the arts, there exist naïve notions about the relationship between the content of the interview/art work, on the one hand, and those parts of the natural and social worlds that are denoted:

According to the naïve notion that the visual arts reflect or reproduce nature, the means of representation have a merely technical (in the bad sense) and purely auxiliary character. They are subordinated to the object being represented and are evaluated according to how they suit it. Thus the means of art are only evaluated as they relate to the extraartistic values of nature or the historical reality which they reproduce. (Bakhtin/Medvedev, 1978, pp. 46–47)

In educational and psychological research, the same phenomenon addressed in this quote with respect to the content of an artistic production often occurs with respect to the production of interviews, the contents of which are evaluated with respect to a historical and biographical reality outside of the interview situation. In the same way that Medvedev/Bakhtin make thematic the relationship between the content of art—here the text about interests and motivations—and the remaining, extra-artistic reality of which the arts are a constitutive part, we have to make thematic the relationship between the interviews about interests and motivations, which are but a part of the extra-research reality of which interviews are constitutive parts. Paraphrasing Bakhtin/Medvedev we suggest that it is naïve to think that the interviews *reflect* or *reproduce* (social, material, psychological) nature and that language, as means of accessing the phenomena of interest, has a merely technical (in the

bad sense) and purely auxiliary character. Thus, textbook instructions for interviewing tend to suggest minimizing the influence of the researcher on the situation, without realizing or making explicit that without the researcher present, the interview would not be an *inter*-view (from Old French *entrevoir*, *entre-*, between, + *voir*, to see). Even in cases where participants are asked to fill out questionnaires or to write unstructured texts (responses, essay) about the phenomena of interest, the writer would be oriented toward a particular recipient and the goals and intentions that he or she has articulated during the invitation of the research participant. Much like classical art criticism thought that the arts are subordinated to the object being represented, modern researchers subordinate the means (open or structured interviews, questions) to the object being represented in the resulting text, here, talk about interests and motivations. The general methodical question asked in the peer-review process and in scholarly discussion pertains to the degree to which the interview has been able to elicit the true interests and motivations, and therefore, the degree to which the method was adequate to the reality of the interests and motivations.

The language of the interview situation and the possibilities it offers to express the world constitute means of representations, devices. With respect to the interview, these devices do not constitute some value external to the interview and a value for its own sake: “The means of representation, the ‘devices,’ do not represent some extraartistic value for its own sake. Instead, they make the work of a self-contained whole and make the phenomenon being represented into a constructive element of this whole” (Bakhtin/Medvedev, 1978, p. 47). In the same way that Bakhtin/Medvedev articulate the issue for the arts and the artistic work, we propose considering the interview situation as a self-contained whole—nevertheless related to the world in its entirety—in which the phenomenon represented, interests and motivations, are constructive moments of this whole.⁴ In the present instance, the whole is the interview and the material traces it leaves in the mechanical (video) record and the transcriptions subsequently produced from it. That is, the phenomenon represented in interview talk—in our examples the career interests and motivations students express—are constitutive moments of the interview as a societal phenomenon *sui generis*.

The relationship between the interests and motivations articulated in an interview and any interests and motivations apparent to the individual in other life situations is oblique rather than direct. At best we might say that in the interview situation, everyday interests and motivations are ideologically *refracted* (Bakhtin/Medvedev, 1978). The relationship between Jennifer as constituted in the interview and the person in her everyday life is the same way that a particular kind of person in a novel—a protagonist representing the *nouveau riche*, the author’s double in an autobiography—is a constructive but ideologically refracted moment of the art work rather than an unmediated reflection of reality. Who Jennifer generally and her interests and motivations specifically can be in the interview situation is subject to the (autobiographical) genres possible for such types of situations and the constructive purposes for the story as a whole. The possibilities for construing a character, with interests and motivations, are subject to certain constraints that have to do with the narrative possibilities of characters and plots available to a particular culture and language. Bakhtin/Medvedev already framed these constraints for the artistic work: “The object perceived from the point of view of

⁴ We use the notion of *moment* rather than that of *element*, because the latter implies that the whole we are interested in, the interview situation, can be reduced to certain elementary structures, from which the

this representational system, as a possible constructive aspect of it, for the first time becomes an object of artistic perception” (p. 47). That is, interests and motivations, viewed from the perspective of the interview and the linguistic and graphical representations that it makes available and possible, come to be understood *as objects* of the perception by the means of the interview.

CODA

In this chapter, we show that the interview situation, both with respect to process and product, is constitutive of the psychologists’ phenomenon of interest and motivation. What the research on interests and motivations can reveal is only obliquely related to social life in general and has to be understood within the unity of the interviews that produce the recorded texts that subsequently are used as data sources for the construction of interests and motivations as research outcomes. Our position is radical in a scholarly context that normally takes the elicitation of interests, motivations, cognitions, emotions, and so on in interview situations as unproblematic as long as the means are judged sufficient: *the interview is a special situation and its products (interview) do not directly reflect the reality of the phenomenon in other contexts; and, in turn, the requirement for narratives to have characters, plots (the content), and chronotopes becomes a constitutive moment of the interview.* Our position is as radical as it was for a cultural-historical, materialist dialectical literary criticism during the early part of the 20th century. Thus, the constructive function of the interview in the reality of interests and motivations is as salient as the constructive function of the arts in our understanding of the world that we inhabit: “The primacy of the constructive function radically revolutionizes this notion. The object of representation—the natural or historical phenomenon—is now evaluated in terms of the means of representation, i.e., in terms of its constructive role in the closed unity of the work, in terms of its constructive expediency” (Bakhtin/Medvedev, 1978, p. 47). As in the analogy of the artistic phenomena, interests and motivations exist in the way they do for researchers, in research reports, and subsequently in the educational fields where the research findings subsequently come to be applied in the way they can be articulated in and through the interview. That is, the interview situation is constitutive of what interest and emotion can be and are in the way that they are detected and described—e.g., by teachers, guidance counselors, school nurses—in the world outside the interview situation. Interests and motivations are bound up with the plots, characters, and chronotopes possible, plausible, and intelligible in the context of the interview, where interviewer and interviewee talk *to*, *with*, and *for the benefit of* the other.

The relationship is not unidirectional, however, as the researcher’s and the research participant’s everyday competencies in interest and motivation talk mediates how the interview as process unfolds and the objective trace the process leaves in the recorded and transcribed interview text. Both interviewers and interviewees do not talk like monads in some box labeled “interview,” but they make interviews in and through their talk in addition to constituting the topic. The topic, however, must not be understood outside the interview text that the interview process produces. That is, we must not take the text produced during

phenomenon could be constructed. Moments, on the other hand, though identifiable structures, cannot be understood outside of the whole and independent of all the other identifiable structures.

the interview outside the context that led to its production. Paraphrasing Bakhtin/Medvedev we might say that the interview text—in the same way as the outcome of any other form of work—cannot be understood outside the unity of the interview and the research that it realizes. “But this whole unity and the individual works which are its elements cannot be understood outside the unity of ideological life. And this last unity, whether it is taken as a whole or as separate elements, cannot be studied outside the unified socioeconomic laws of development” (p. 27).

This double relation is also a reason to be concerned when the production of the interview and the resulting text is not taken into account in the construal of interests and motivations. In this case, educational psychologists and other researchers in the field either come to reap what they had earlier sown or simply reify the “commonplaces of ordinary existence or official representations, often inscribed in institutions and thus present both in the objectivity of social organizations and in the minds of their participants” (Bourdieu, 1992, p. 235). The very possibility for the existence of the phenomenon in the social world also comes with a danger for the researcher, who might take the preconstructed, which can be found everywhere, and who might merely operationalize and thereby reify the concepts. The educational psychologist, in the same way as the sociologist,

is thus settled with the task of knowing an object—the social world—of which he is the product, in a way such that the problems that he raises about it and the concepts he uses have every chance of being the product of this object itself. (This is particularly true of the classificatory notions he employs in order to know it, common notions such as names of occupations or scholarly notions such as those handed down by the tradition of the discipline.) (Bourdieu, 1992, p. 235)

The self-evident character of the concepts and the phenomena that (unreflective and unreflexive) researchers denote arises from the fit between objective structures embodied in the societal relations that members of society continually produce and reproduce, on the one hand, and the subjective structures that allow them to see the objective structures for what they are, on the other hand. This homology of the objective and subjective structures is the very reason that shields the former from questioning by the latter. It is precisely because interest and motivation talk are prevalent in society that educational psychologists can study these phenomena, and they can do so because (a) the interests and motivations constitute objective social facts and (b) they themselves have acquired the competencies to detect interests and motivations in everyday talk. Our method was developed in part to counter the danger that arises from simply reifying the phenomena that we see because we have been previously shaped by these very phenomena. Instead, discursive, critical, and cultural-historical psychologists focus on how such things as interests and motivations are mobilized as resources during and for the purposes of talk-in-interaction.

The approach that we describe here allows researchers to make thematic the differences between interests and motivations that exist when these are objects of educational psychological research (e.g., talk at a conference, talk in research articles such as the ones cited here by Suzanne Hidi or Andreas Krapp), when they constitute the topic of talk in interviews (e.g., the ones from which the present episode were extracted), or when they are used as discursive resources in everyday life situations, such as when high school or university students talk with their peers about what they want to do after graduation. Our

approach is intended to provide a set of tools that allow educational psychologists to better understand interests and motivations, not as internal features of some person, but as resources for the conduct of social life. Interests and motivations no longer are the free-floating phenomena that they have been—as something that comes to be attached to or is had by singular individuals—but that are societal phenomena through and through. This understanding opens up a new horizon that allows us to rethink our relationships with others, with the society, and with the whole lifeworld in a more sophisticated way and so problems—such as using the idea of individual interests as a tool for the producing the ruling relations of society—can be better addressed.

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APPENDIX

TRANSCRIPTION CONVENTIONS

In this chapter, we draw on transcription conventions common to conversation analysis enhanced by transcription features specific for researchers interested in marking prosody (Selting et al., 1998). The transcription is neither grammatical—see punctuation—nor consistent with spelling rules but attempts to exhibit the sounds as produced.

Feature in context	Explication
(0.25)	Time in hundreds of seconds
(.)	Pause less than 0.10 seconds
((draws line))	Double brackets surround transcriber comments.
hh, uh	Outbreath, each "h" corresponding to 0.1 seconds.
survi:ve	Colon indicates lengthening of phoneme, each colon corresponding to 0.1 seconds.
r=one	Equal sign means "run-in" of the phonemes or "latching" of different speakers, meaning no pause between phonemes.
084 <<p>point [he:re] 085 [than with]	Square brackets in consecutive turns indicate extent of overlapping speech, features.
:,;?	Punctuation marks indicate movement of pitch toward end of utterance segment, down, strongly down, up, and strongly up, respectively
<<rall>first>	"rallentando," increasing speech rate.
`b 'clear, ^okay	Diacritics indicate movement of pitch: downward, upward, and up-downward contour of syllables that follow.
OR	Capital letters indicate louder than normal speech.

Chapter 3

**READING FLUENCY AND DYSLEXIA:
INNOVATIVE DEVELOPMENTS IN THE ROLE OF
ASSOCIATIVE LEARNING AND REPETITIVE
EXPOSURE IN SKILL ACQUISITION**

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ABSTRACT

In this chapter we will engage in a theoretical quest for ways to ameliorate reading fluency in dyslexics. In the first section we will provide an overview of research on dyslexia and dyslexia treatment and we will discuss the limitations of traditional interventions to ameliorate the poor reading fluency of dyslexic children.

In the second section of the chapter we will have a closer look on reading fluency, often referred to as the 'neglected' aspect of reading. We will discuss the essential role of extensive reading experience in the development of reading fluency and focus on repeated reading, the most familiar and most researched approach to fluency training.

A state of the art overview of insights from cognitive neuroscience, concerning fluent and disrupted reading, will be given in the third section of the chapter. In this light we will discuss cognitive, neurobiological and connectionist models on reading development and additionally focus on other areas of skill learning, such as chess.

In the fourth section we will amalgamate the various insights, draw several conclusions regarding fluency-oriented instructional practices, and proposed some new directions for dyslexia treatment. Additionally, we will demonstrate the unique possibilities provided by edugames, or computer-game training, for the implementation of the proposed educational principles. As an example we will present an edugame, called LexyLink, which we developed in our own laboratory and which we are currently testing in our institute.

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INTRODUCTION

When a reporter asked former world chess champion José Capablanca, often referred to as a candidate for the greatest chess player of all time, how many moves ahead he looked while playing, Capablanca replied: "Only one, but it's always the right one". Obviously these words were intended somewhat hilariously and suit the grandeur of a chess champion. However, in the light of modern science these same words capture astonishingly well what is currently known about what distinguishes experts from novices within various domains, namely, that it is fast automatized perceptual recognition that potentiates their superior skill.

In reading this is no different. Skilled readers develop a form of visual expertise that allows them to process print with remarkable efficiency, i.e., the reading rate of a skilled reader surpasses the rate of typical speech. Even words of more than 15-20 characters can be identified within a fraction of a second (Nazir & Huckauf, 2008).

Most people can become highly proficient in reading without considerable effort. Nevertheless, a substantial part of the population experiences major difficulties in mastering reading and spelling skills. When these difficulties occur despite sensory integrity, normal intelligence, and educational opportunity, they are generally designated as dyslexia (Shaywitz, Morris, & Shaywitz, 2008). In transparent orthographies, like Spanish or Finnish and to a lesser extent Dutch, dyslexia is primarily characterized by poor reading fluency (Landerl, Wimmer, & Frith, 1997; Ziegler, Perry, My-Wyatt, Ladner, & Schulte-Korne, 2003).

Although specialized treatment programs are effective in alleviating the reading and spelling difficulties of dyslexics (Elliot, Davidson, & Lewin, 2007; Fletcher, Lyon, Fuchs, & Barnes, 2007; Lovett, Barron, & Benson, 2003; Tijms & Hoeks, 2005; Vellutino, Scanlon, Small, & Fanuele, 2006), these treatment gains hardly ever generalize substantially to fluent reading (Shaywitz et al., 2008; Torgesen, 2005). This is problematic because a lack of reading fluency is assumed to hinder reading comprehension (Samuels, 2002). Hence, identification of educational principles that could enhance reading fluency is one of the central issues of contemporary research on reading.

In this chapter we will engage in a theoretical quest for ways to ameliorate reading fluency in dyslexics. By this means we will provide an overview of research regarding fluent reading and disrupted reading, with a special focus on cognitive neuroscience. The rapid development of functional neuroimaging techniques has given researchers unprecedented access to the behaving brain and there is growing optimism that cognitive neuroscience can make a meaningful contribution to education. In fact there are studies that illustrate the promise of neuroscience by showing how the brain responds to training. For example, Shaywitz and colleagues (2004) found that the activity in the dyslexic brain, which is usually atypical, approximates normal activity after specialized treatment. Moreover, brain imaging has indicated a target (an area within the posterior ventral region of the brain) for fluency-oriented intervention. Additionally, the place-based reporting scheme of neuroimaging has indicated that there are similarities between fluent reading and other forms of high proficiency of skill on a neural level. In our quest we will therefore also attend to the paradigm of expert learning and return to Capablanca and his self-contemplation.

A final contribution from neuroscience to education comes from connectionist models of reading. These models complement behavioral and neuroimaging studies. We will end this

chapter by putting forward some promising new directions for treatment, with an emphasis on fluency-oriented educational principles. As an example we will present an intervention program, called LexyLink, which we developed in our own laboratory and which we are currently testing in our institute.

DYSLEXIA AND DYSLEXIA TREATMENT

Dyslexia

The ability to read and write allows people to transcend their confinement to time and space, and therefore is the central focus of attention in education. Nevertheless, as stated in the introduction, a substantial part of the population experiences major difficulties in mastering reading and spelling skills. The term dyslexia typically is invoked when these difficulties are unexpected in relation to other cognitive abilities and adequate education (Shaywitz, Morris, & Shaywitz, 2008).

Dyslexia is considered to stem from a deficit in the phonological processing system, which disrupts the development of phonemic-graphemic associations (Shaywitz et al., 2008; Sprenger-Charolles, Colé, & Serniclaes, 2006). A subtle neurological defect that is associated with a genetic predisposition, is assumed to be the underlying factor (Galaburda, LoTurco, Ramus, Fitch, & Rosen, 2006; Fisher & Francks, 2006; McGrath, Smith, & Pennington, 2006). Recent work suggests that genetic disruptions interfere with neuronal migration, leading to atypical neural organization (Burbridge et al., 2008; Galaburda et al., 2006; Meng et al., 2005; Velayos-Baeza, Toma, Paracchini & Monaco, 2008).

Dyslexia has a relatively high prevalence and has been described in all writing systems, including logographic ones (Goswami, 2007). Prevalence estimates typically range from 3% to 10% of the population (Eden & Moats, 2002), with a slight preponderance of males over females (Rutter et al., 2004). Despite being often labeled as a childhood disorder or a developmental lag, dyslexia is a persistent difficulty, which must be recognized and addressed early (Shaywitz et al., 2008). In adults, dyslexia is associated with low self-esteem, anxiety, depression, social isolation, and increased risk of developing psychopathological problems (Esser, Wyschkon, & Schmidt, 2002; Ruijsenaars, De Haan, Mijs, & Harinck, 2008). Up to a certain extent such problems are already manifest during primary school (Ingesson, 2007; Maughan & Carroll, 2006).

With the rise of the information society, in which written communication is essential, the burden of dyslexia on both individual and society will be increasingly high. Hence, a focus on adequate treatment for dyslexia is indispensable.

TREATMENT OF DYSLEXIA

As dyslexia is the most common and the most carefully studied of the learning disabilities, significant progress has been made in understanding the cognitive basis of dyslexia and in using this knowledge to ameliorate instructional practices (Shaywitz et al., 2008). It seems that typical instructional practices within the public school as well as facilities

within special education are able to stabilize the degree of reading failure of dyslexic pupils, but are not proficient in normalizing their reading skills (Torgesen, 2005). Therefore, most dyslexics have to rely on specialized treatment programs.

Extensive literature on prevention and intervention of dyslexia indicates that treatment can be successful, and sheds light on which ingredients are responsible for that success. Positive results have been reported in studies evaluating phonologically based prevention and intervention methods (Elliot et al., 2007; Fletcher et al., 2007; Fuchs & Fuchs, 2006; Lovett et al., 2003; Tijms & Hoeks, 2005; Vellutino et al., 2006).

It seems that prevention programs that explicitly focus on phonemic awareness, phonics, and semantics reduce the risk of developing reading difficulties (Fuchs & Fuchs, 2005; Vellutino et al., 2006). Similar ingredients are associated with positive outcomes in intervention methods (Elliot et al., 2007; Fletcher et al., 2007; Hatcher, Hulme, & Snowling, 2004). The most effective treatment programs include training in phonetic awareness that is explicitly linked with systematic instruction in reading (Elliot et al., 2007; Hatcher, Hulme, & Ellis, 1994). A supplementary focus on teaching children metacognitive strategies to assist in word identification appears to be of additional value (Lovett et al., 2003).

From a more formal didactic point of view, evidence indicates that successful interventions are intense, systematic, and explicit (Shaywitz et al., 2008). Indeed, specialized intervention is usually extensive with an average duration ranging predominantly from 50 to 80 hours (Torgesen, 2005).

Although phonology-based treatment evaluations revealed positive effects, the durability of these effects after treatment is stressed in a few studies only (Hatcher et al., 1994; Tijms, Hoeks, Paulussen-Hoogeboom, & Smolenaars, 2003; Torgesen et al., 2001). In an extensive study Tijms et al. (2003) showed that a phonology-based treatment program for the Dutch language produced long-lasting effects, i.e., despite a slight decline in spelling proficiency after the first year, the participants maintained their functional levels of reading and spelling.

Notwithstanding the positive outcomes associated with phonology-based interventions, one notable result is that reading rate is less susceptible to intervention than reading accuracy (Shaywitz et al., 2008; Lyon & Moats, 1997; Torgesen, 2005). However, it seems that, as opposed to reading accuracy, reading rate continues to develop after termination of specialized treatment (Tijms, 2007). Identification of instructional elements that are capable of improving reading rate, and by that reading fluency, is one of the central issues of contemporary research on reading (Kame'enui & Simmons, 2001; Kuhn & Stahl, 2003; Lyon & Moats, 1997; Shaywitz et al., 2008; Torgesen, 2005).

WHAT ABOUT FLUENCY

Reading Fluency

Traditionally, reading fluency has received far less attention than reading accuracy and has been frequently nominated as the 'neglected' aspect of reading (Allington, 1983; Pikulski & Chard, 2005). In recent years however, this topic has gained the interest of both researchers and practitioners (e.g. Kuhn & Schwanenflugel, 2007), with special attention for the dynamics that lead to reading fluency (Kuhn & Stahl, 2003).

There are several definitions of reading fluency mostly stressing accuracy, rate, and prosody as the key elements (Hudson, Mercer, & Lane, 2000; Kuhn & Stahl, 2003; Torgesen & Hudson, 2006). Fluency is usually associated with effortlessness and is hence characterized by the ability to maintain the reading performance for long periods of time, to retain the skill after long periods without practice, and to generalize across texts (Hudson, Lane, & Pullen, 2005). The effortlessness also leads to an inability to suppress reading (Everatt et al., 1999). Even when skilled readers are expressly asked to pay attention solely to trivial aspects of words (e.g. color or ink), they appear to be unable to suppress reading (Noble & McCandliss, 2005). Sprenger-Charolles, Colé, and Serniclaes (2006) appropriately refer to this phenomenon as the written-word identification “reflex”.

A lack of reading fluency conversely is marked by slow, hesitant, and laborious reading, which is assumed to hinder reading comprehension (Samuels, 2002). Indeed, a correlation between fluency and reading comprehension is clearly established (Johns, 1993; Pinnell et al., 1995). The putative causality of this correlation was elucidated in a seminal article by LaBerge and Samuels (1974). They stated that attention expended upon one activity is, inevitable, attention unavailable for another. Since comprehension depends on meta-cognitive processes, it cannot be automatized. It is therefore necessary to automatize the decoding aspect of reading in order to free capacity for the meta-cognitive process of constructing meaning. When failing to do so, one must constantly alternate attention between the two processes.

A central question regarding fluency is how it originates within reading development. Ehri (2002) describes reading development as a stage-like process ranging from being a non-reader to the point where words are recognized effortlessly. Through a thorough analysis of their structure, words become sight words, in the sense that they belong to the ‘instant recognition repertoire’ of the reader. In her model, Ehri identifies four developmental stages: pre-alphabetic, partial alphabetic, full alphabetic, and consolidated alphabetic. In the pre-alphabetic stage the beginning reader has no insight into the alphabetic principle yet, and thus uses visual characteristics or clues from the context to identify printed words. When the reader starts to relate sounds to specific easily identifiable parts of the word, mostly at the beginning and endings, it has reached the partial alphabetic stage. The full alphabetic stage is characterized by the ability to attend consciously to all of the sounds within a word. This ability makes it possible to decode words that are presented for the first time. In the final stage, the consolidated alphabetic stage, repeated exposure to print leads to a chunking process in which larger patterns of letters are recognized, facilitating more rapid identification and processing of words during reading.

Chall (1996) also relates fluency to a theoretical framework in which reading proficiency proceeds through developmental stages. She particularly stresses the importance of gaining familiarity with sound-symbol correspondences, which leads to a stage in which the reader is not learning new skills, but confirming what is already known. Chall’s model partly coincides with Ehri’s, but also focuses on reading comprehension in addition to decoding.

The view of reading development as a series of qualitatively different stages through which learners proceed, does not necessarily mean that the reader goes through one stage at the time. In fact it is plausible that this development proceeds in an item based fashion, in which for some words the reader must rely heavily on effortful decoding, while other words are already processed automatically (Share, 1995). Perfetti (1992) suggests that readers may

actually need to proceed through all stages with every single word in order to assure efficient processing.

Usually, the development of fluency is associated with huge amounts of experience with print. Furthermore, the different accounts agree on that the instant recognition of words is fundamentally phonologically underpinned (e.g. Perfetti & Liu, 2005). These assumptions lay the foundation of the self-teaching hypothesis (Share, 1995), in which it is proposed that words can only be stored as orthographic representations if they can be decoded correctly. According to this hypothesis, phonological recoding of new words comprises a self-teaching mechanism, which provides an opportunity to acquire word-specific orthographic information and thereby facilitates fast word recognition. Evidence in support of the self-teaching hypothesis comes from various studies (Share, 1999, 2004; Cunningham 2006). The self-teaching mechanism also appears to be active in silent reading (De Jong & Share, 2007). The ability to use contextual information is thought to be important, because in cases of partial decoding it can provide clues on how words are pronounced (Share, 1995). In a recent study, Landi et al. (2006) confirmed this assumption, but interestingly, they also found that retention was superior for words learned in isolation. Moreover, this benefit from learning in isolation was larger for less skilled readers. Landi and colleagues explained their findings by stating that semantic context allows the readers' attention to be drawn away from word decoding. Since less skilled readers have a greater need to focus on letter-sound processing due to their poorer decoding skills, less attention to the word form will have more serious consequences for them.

The idea that phonological decoding provides the fundamental basis for the subsequent development towards a more fluent reading proficiency, or as Share describes it, that phonological decoding is the *sine qua non* of reading acquisition, is supported by more general accounts of skill acquisition. According to Siegler's (2005) model of learning and development, learning is the result of a metacognitive and an associative mechanism, which interact to produce a single acquisition. Research on this model indicated that when children are novices in a domain, the explicit metacognitive learning mechanism plays an important role by explicitly directing each step in a strategy, thereby feeding the associative system. With growing experience, the role of the metacognitive system diminishes while the associative mechanism develops a fast, automatized analogue of the metacognitive version of the skill (Crowley, Shrager, & Siegler, 1997). Correspondingly, it is noted that full automaticity of grapheme-phoneme associations, in the sense that they become instrumental in fluent reading, takes much longer than the acquisition of passive knowledge of them (Blomert, 2005; Sprenger-Charolles et al., 2006).

Although the efficiency of decoding is normally considered as the major distinctive component of reading fluency, Wood, Flowers, and Grigorenko (2001) stress the additional importance of anticipatory processing. The idea is that preliminarily processing of the words yet to come, facilitates the following response to them. On a lower level, this account implicates that during decoding practice a conscious focus is needed on the word towards the individual phonemes lead. Besides this "proactive" facilitation, there is also "retroactive" facilitation, in which the identification of a word is influenced by the familiarity of a succeeding word or words. In general, the function of anticipatory processing in fluency emphasizes the importance of goal-directedness in learning to read (Wood et al., 2001; see also Usacheva, Lazareva, Vostrikova, & Shcherbakova, 2007). The role of anticipatory processing has already been demonstrated within the Rapid Automatized Naming (RAN)

paradigm, in which processing of laterally displayed series of individual items (such as colors or numbers) seems to be faster than that of separately presented stimuli (Wolf, 1991). In the end, as argued by Wood et al. (2001), just as dancing becomes fluent by the integrative processing and execution of a sequence of postures, skilled, fluent reading is more characterized by integrative, and therefore anticipatory, processing than with item-by-item recognition and response.

Current Accounts on Enhancing Reading Fluency

As noted earlier, one consistent finding in dyslexia research is that, despite their success in ameliorating accuracy in reading and spelling, traditional interventions are insufficiently able to normalize reading fluency. However, a number of different instructional approaches have been specifically developed to improve fluency. Some of these approaches have been designed for usage within the classroom, while others are intended for individual remediation. Unfortunately, the circumstances in which these approaches are executed are far less structured than those within traditional treatment, which makes the existing data regarding their effectiveness less adequate for scientific analyses. Moreover, the heterogeneity of the target group also hinders reliable inferences. Nevertheless, some valuable review studies have been published recently (Chard, Vaughn, & Tyler, 2002; Kuhn & Stahl, 2003). In the overview by Kuhn and Stahl, detailed descriptions of the various methods can be found. It seems that fluency instruction is generally effective (Kuhn & Stahl 2003), although no evidence is available that fluency-oriented approaches can produce normalization of fluency in dyslexics (Torgesen, 2005). Furthermore, it is unclear whether the effectiveness of these approaches is the result of specific instructional characteristics or just the consequence of augmented reading experience (Kuhn & Stahl, 2003).

Many authors stressed the essential role of extensive reading experience in the development of reading fluency (Kuhn & Stahl, 2003; Nathan & Stanovich, 1991; Torgesen 2005; Torgesen & Hudson, 2006). A major consequence of limited reading practice is that the amount of words in the instant recognition repertoire remains small (Ehri, 2002). Notably, in a frequently cited study by Anderson, Wilson, and Fielding (1988), it was investigated how much time 5th graders spend on reading outside school. Ample differences were found between good readers and poor readers in the amount of reading. Their data suggested that an entire year's worth of out-of-school reading for the child at the 10th percentile of reading ability equals just 2 days' reading for the child at the 90th percentile (Torgesen, 2005). In a series of studies, Cunningham and Stanovich expanded on the topic of print exposure and its relation to cognition (e.g. Cunningham & Stanovich, 1998, 2003; Stanovich & Cunningham, 2004). They found that individual differences in word recognition ability are, at least in part, determined by print exposure differences (Cunningham & Stanovich, 1993).

Accordingly, most fluency-oriented instructional programs include extensive amounts of reading practice. We will focus here on repeated reading, the most familiar and most researched approach to fluency training. This technique consists of repeatedly reading passages of text or isolated words, until a certain rate is reached.

Repeated reading of isolated words was traditionally put into practice using index cards containing the intended words. These so called flashcards were presented within a specific time period (usually less than a second). Nowadays, this flashcard paradigm is commonly

used within practice, though in a computerized fashion, i.e., words are shortly presented on a computer screen. Evaluation studies indicate that flashcard training can enhance the reading rate of poor readers (Berends, 2005; Berends & Reitsma, 2006; Martin-Chang & Levy, 2005). Children learn to read the presented words faster and more accurately after a few sessions and there seems to be no decline at all in treatment gains after the treatment has stopped (Berends, 2005). However, there is no evidence that reading rate can be normalized in the poorest readers with this kind of training (Berends, 2005; Thaler, Ebner, Wimmer, & Landerl, 2004). Furthermore, studies failed to reveal substantial transfer of effects (Berends & Reitsma, 2006; Hintikka, Landerl, Lyytinen, & Aro, 2008). Of course, it can still be useful to practice with flash cards, even without transfer effects. After all a reader can elaborate its instant recognition repertoire by this means and it seems that only few encounters with a word are necessary to store its orthographic form in long term memory (Reitsma, 1983). However, in the case of dyslexia it is consistently reported that much more repetition is needed (Hintikka et al., 2008; Reitsma, 1983; Thaler et al., 2004). In the absence of transfer effects, flashcard training is therefore less suited for dyslexics. Recent studies suggest that emphasizing sub-lexical units instead of words within the flashcards paradigm might be a promising way of enhancing generalization of effects (Hintikka et al., 2008; Martens & de Jong, 2006).

The understanding of reading fluency has grown significantly with the rise of cognitive neuroscience. In the next section, we will discuss how the behavioral aspects of fluent reading are anchored in the brain, what is different in the dyslexic brain, and what connectionist models tell us about how reading fluency originates. Furthermore, we will explore other areas of expert learning in the light of reading fluency.

A COGNITIVE NEUROSCIENTIFIC PERSPECTIVE

The rise of neuroscience, with its rapid development of functional neuroimaging techniques, such as functional magnetic resonance imaging (fMRI), and its sophisticated modeling of neural networks, has brought a wave of new insights into learning and development. Therefore, it is not surprising that there is a considerable amount of optimism about the valuable contribution neuroscience can make to education (Battro, Fischer, & Léna, 2008; Szűcs & Goswami, 2007; Varma, McCandliss, & Schwartz, 2008). Uncovering how fluency develops in the normal brain and how it is disrupted in the dyslexic brain, can help us finding effective ways to enhance it.

The Neural Basis of Fluent and Dyslexic Reading

Fluent adult readers are able to identify written words in a split second. The functional organization within their brain is globally divided into a posterior dorsal system and a posterior ventral system, which are respectively associated with phonological and orthographic processing (Pugh et al., 2001; Schlaggar & McCandliss, 2007). The dorsal system, which comprises mainly the perisylvian region including the supramarginal gyrus, angular gyrus, and superior temporal cortex, is believed to be specifically important for accuracy within the reading process, where the ventral system, which includes lateral

extrastriate areas and a left occipito-temporal area, is assumed to be specifically related to fluency (Lyytinen et al., 2005; Pugh et al., 2001).

Converging findings indicate that both the dorsal component and the ventral component are impaired in dyslexia, which is functionally manifested by decreased activity. Evidence comes from functional neuroimaging studies (Brunswick et al., 1999; Paulescu et al., 2001; Shaywitz et al., 1998; Temple, 2002) as well as from anatomical accounts (Beaulieu et al., 2005; Gaillard et al., 2006; Galaburda, 1992; Klingberg et al., 2000; Niogi & McCandliss, 2006). To the contrary, activation in inferior frontal and right hemisphere posterior regions is heightened in reading-disabled individuals, relative to nonimpaired readers (Brunswick et al., 1999; Shaywitz et al., 2002). This atypical frontal and right hemispheric activation is commonly attributed to compensatory strategies (Pugh et al., 2001; Shaywitz et al., 2002). The neurobiological dysfunction in left hemisphere posterior reading circuits is already present in reading-disabled children and is not the result of a lifetime of poor reading (Shaywitz et al., 2002; Temple et al., 2001).

As reading fluency is the focus of this discourse we will elaborate on the associated posterior ventral system. Converging evidence indicates that a functional specialization within this system is responsible for the kind of perceptual expertise that is seen in fluent reading (Cohen et al., 2000; McCandliss et al., 2003; Cohen et al., 2002). This functional specialization is currently designated as the visual word form area (VWFA), although its specificity has been under continuing debate (Cohen et al., 2004; Price & Devlin, 2003). The VWFA is characterized by fast and parallel identification of letter strings, irrespective of case, font, size, and retinal position (McCandliss et al., 2003) and can be seen as the biological source behind the earlier mentioned 'instant recognition repertoire'. The causal role of the VWFA in reading is supported by lesion studies (Gaillard et al., 2006; Philipose et al., 2007). The VWFA is sensitive to learned letter stimuli, but not to other control shapes and spoken words (McCandliss et al., 2003). VWFA responses are even measurable when a subject perceives a word unconsciously (Dehaene et al., 2001). The VWFA is among the most consistently activated regions in quantitative meta-analytic studies of adult reading (Schlaggar & McCandliss, 2007) and its exact location within the left mid-fusiform gyrus seems to be very consistent across individuals (Jobard et al., 2003) and across cultures and writing systems (Bolger et al., 2005).

Most research on the VWFA uses skilled adult readers as subjects, which represent the end-state of reading development. However, in order to understand the emergence of fluent reading on a neural level, it is particularly important to focus on the changes the brain undergoes in the process of acquiring the skill. Developmental studies suggest that VWFA responses are tightly correlated with reading skill (Shaywitz et al., 2002) and that during the ages when reading skill is acquired, a transition takes place from bilateral occipitotemporal involvement to a predominance of left-lateralized occipitotemporal involvement (Turkeltaub et al., 2003). The perceptual expertise which is associated with the VWFA seems to develop gradually with reading experience and is still not at adult levels even after five years of reading practice (Aghababian & Nazir, 2000). Sandak et al. (2004) found that increased activity in a left ventral occipitotemporal region correlates more with reading skill than with age, which suggests that experience is involved in the functional development of this region. In a longitudinal study Shaywitz and her colleagues (Shaywitz et al., 2004) were able to link improved reading skill in reading disabled children after intervention with increased activity

of the VWFA. This result also supports the assumed role of experience in the development of the ventral region and emphasizes the importance of educational activities.

Further insight in the developmental course of the VWFA comes from event-related potential (ERP) studies. ERP studies in skilled readers have shown that visually viewing a word leads to peaks between 150 and 200 ms, which are characterized by posterior negativity. Specifically the left-lateralized N170 (or N1) response has been linked to activity of the VWFA (Brem et al., 2006). The reading-related N170 response is also manifest in tasks that do not require the words to be read, and consequently appears to be automatic (Maurer et al., 2005). In reading disabled adults, specific activity for visual words seems to be absent within the 150 and 200 ms timeframe (Helenius et al., 1999).

Evidence for an experience-based nature of this N170 response comes from different studies. Maurer et al. (2005) found that, although many of the participating 6-year-old kindergarten children were familiar with letters, their N170 responses were delayed, not solely sensitive for visual words, and not lateralized to the left hemisphere. The adults, participating in the same study, by contrast showed the expected left-lateralized activation within 200 ms when presented with visual words. In consecutive studies Maurer and colleagues (Maurer et al., 2006; Maurer et al., 2007) followed the children from the previous study longitudinally and found that a N170-like response for visual words emerged within two years of formal reading instruction and that the coarse tuning appeared stronger for the more skilled readers, which supports the notion of an experience-based nature. The results also demonstrated that visual tuning for print, as well as the behavioral measures of reading skill, developed more slowly in children who later turned out to be dyslexic. Comparing 2nd graders and adolescents with adults within the same paradigm revealed further changes in the N170 response for visual words compared to other visual stimuli, presumably reflecting augmented reading experience (Maurer et al., 2006; Brem et al., 2006). Another ERP study with four, seven, and ten-year-old children, showed that only at age ten a small but delayed N200 response with sensitivity to words over consonant strings, occurred (McCandliss, Posner, & Givon, 1997).

Until now, the global activation of the VWFA has been the major target of investigation, however recently the internal organization of this region has received significant attention as well (Bolger, 2007; Dehaene et al., 2005; Dehaene, 2008; Vinckier et al., 2007). Vinckier et al. (2007) found evidence for a posterior to anterior hierarchical organization of neurons, responding to increasingly larger and complex components of words. This means that with more anterior or left-lateralized activity, there is an increasing preference for stimuli resembling real words. Vinckier and colleagues conclude that this hierarchical organization must result from a tuning process during reading acquisition. Interestingly, this is in line with the stage-like models (e.g. Chall, 1996; Ehri, 2002) of reading development within the cognitive domain. From this point of view, the VWFA can be seen as the neural correlate of this tuning process, whereas the stage-like development of reading can be seen as the behavioral correlate of the same tuning process. When this tuning process is efficient, the developing reader becomes sensitive to increasingly larger components within words, resulting in instant word recognition, facilitating fluent reading.

Unifying the various neurological insights regarding normal and disrupted reading development, members from the Haskins laboratories (Pugh et al., 2001) proposed a tentative model, which subsequently received support from other authors (McCandliss & Nobel., 2003; Schlaggar & McCandliss, 2007). In their view, the development of the posterior dorsal

reading system acts as a bootstrapping mechanism for the subsequent development of the posterior ventral system. Whereas the dorsal region is involved in learning to decode print, the ventral region develops with reading experience into a system that identifies words in an automatic manner. Consequently, deficient dorsal function will fail to support adequate ventral development. The shift to inferior frontal activity reflects a compensatory strategy in which articulatory support is pursued in order to cope with phonological processing difficulties. The second shift, from left to right hemispheric ventral activity, is likely to be associated with more general visual compensatory strategies.

Correspondingly, within reading acquisition the reader initially depends on the dorsal circuit to learn to decode, which, with more efficient attention to regularities of grapheme-phoneme mapping, feeds the gradual specialization of the ventral system (McCandliss & Nobel, 2003; Pugh et al., 2001). This model fits well with the cognitive accounts of reading acquisition proposed by Ehri (2002) and Chall (1996) and with Siegler's model of learning and development (Siegler, 2005). As we will show in the next paragraph, similar developmental progression is seen within connectionist models.

Connectionist Models of Reading Acquisition

Connectionist models are designed to approximate the core properties of neural computation and offer us new ways of studying reading acquisition. Assumptions about cognitive processes can be tested by simulating them in artificial networks. In the last two decades, various models have provided insights about many aspects of normal reading and disrupted reading (Lupker, 2005; Plaut, 2005; Seidenberg, 2005). In the present discourse, we will focus on models that 'learn' to relate print to speech and meaning. One of the most prominent of these models is the triangle framework, which was introduced in the late eighties by Seidenberg and McClelland (1989) and elaborated in subsequent years (Seidenberg, 2005). The triangle framework is based on the assumption that word recognition involves orthographic, phonological, and semantic representations. First, the model needs to learn connections between phonology and semantics. Once the model reaches a certain level of proficiency in these connections, orthography is introduced additionally. By this, the model mirrors the real situation in which a child already has well-developed knowledge about sounds and meanings of words when reading instruction starts. Simulations with this model show two occurring pathways from print to meaning: a direct pathway from orthography to semantics and an indirect pathway from orthography to phonology and from phonology to semantics. Interestingly, early in the model's training semantic activation largely depends on the phonology-mediated pathway. Over time, however, the direct pathway becomes more dominant, particularly for high-frequency words. Nevertheless, when a high level of proficiency is reached, the phonology mediated pathway still contributes considerably. Clearly, this model shows high resemblance with cognitive accounts on reading acquisition. Early on, decoding is the central aim of attention, but with experience, word recognition becomes an automatized process.

In another connectionist model, Harm and colleagues (Harm & Seidenberg, 1999; Harm, McCandliss, & Seidenberg, 2003) investigated the consequences of manipulating neural properties of the phonological system on reading performance. Interestingly, their model began to exhibit symptoms of dyslexia after simulating neural damage to the phonological

system in advance. As summarized by Sprenger-Charolles, Colé, and Serniclaes (2006), experimental studies revealed some interesting findings related to these network models. It was shown that in visual word recognition the activation of orthographic codes precedes the activation of phonological codes in time, which on their turn precede the activation of semantic codes (Ferrand & Grainger, 1993; Perea & Gotor, 1997). Moreover, results revealed that phonological codes are activated earlier and more automatically in skilled readers than in less skilled readers (Booth, Perfetti, & MacWhinney, 1999), and individuals with dyslexia show a deviant activation of the phonological codes of written words (Booth, Perfetti, MacWhinney, & Hunt, 2000). In connectionist network terms, these results suggest a dysfunction at the phonological level and/or a disrupted development of connections between orthography and phonology in dyslexic readers.

Taken together, it can be concluded that the characteristics of these connectionist network models of reading are in accordance with the aforementioned neurofunctional findings on fluent and dyslexic reading. Another field of research which enjoys huge amounts of attention from cognitive neuroscience and which can contribute to the current discourse is that of expert learning.

Expert Learning

Generally, there is only a small number of experts within a domain, in the case of reading the opposite seems true, i.e., within literate society just a minority fails in becoming an expert reader. Consequently, high reading proficiency is easily taken for granted. However, the ostensible naturalness of skilled reading can restrain us from thinking about it as a form of expertise. Considering reading acquisition as a form of expert learning gives us the opportunity to explore other areas of expert performance and to derive new insights from them, which can be useful for reading instruction.

In recent years, cognitive neuroscience played an important role in uncovering the underlying neural mechanisms in chess expertise. Since De Groot's (1949) seminal doctoral dissertation on chess expertise it is known that, contrary to what is commonly thought, skilled players do not think further ahead than less skilled practitioners. What makes them different though, is their strikingly superior memory for briefly presented chess positions. However, subsequent research by Chase and Simon (1973a, 1973b) revealed that this superior perceptual memory only holds for legal chess positions, i.e., when pieces are randomly arranged on the board skilled players perform only slightly better than novices. Interestingly, in a recent fMRI study it was revealed that chess experts recruit neural mechanisms in the posterior ventral circuit, just as skilled readers do (Righi & Tarr, 2004). So, it is plausible that a specialized neural mechanism, analogues to the VWFA, is responsible for fast identification of meaningful configurations on the chessboard. This clarifies the preference for legal positions, and fits with existing cognitive accounts on the nature of superior perceptual abilities in chess, in which it is assumed that chess experts perceive positions in meaningful chunks (Chase and Simon, 1973a) and templates (Gobet & Simon, 1996). Moreover, as witnessed by Capablanca's introspective description of his abilities, it confirms that in chess, just as in reading, the expert experiences its high proficiency as a "reflex".

Interestingly, as shown by fMRI and ERP studies, the role of the posterior ventral system in visual expertise is not restricted to reading and chess, but also seems to play part in the

identification of faces (McKone, Kanwisher, & Duchaine, 2007) birds and dogs (Tanaka & Curran, 2001), cars (Gauthier, Curran, Curby, & Collins, 2003), fingerprints (Busey & Vanderkolk, 2005), and even 'greebles', which are newly created 3D figures for experimental use (Rossion, Gauthier, Goffaux, Tarr, & Crommelinck, 2002). Thus, it seems that with appropriate experience a pre-existing natural brain system can be efficiently reused for various cultural purposes, including reading and chess playing (Dehaene & Cohen, 2007; Dehaene, 2008). However, what appropriate experience is necessary to obtain high proficiency? In the case of expert recognition of faces, birds, dogs, cars, fingerprints, and greebles, it seems that repeated encounters with members within these classes are sufficient to induce neural specialization. In the case of chess, more is needed. Since, chess proficiency depends on a combination of slower heuristics and fast pattern recognition, mere exposure is not sufficient. It seems that, just as in reading, there must be a high level of familiarity with the game and a thorough understanding of the dynamics, before subsequent repetition and practice will ultimately lead to fast recognition of game situations (Gobet & Jansen, 2006). However, many years of subsequent practice are necessary to obtain mastery (Charness et al., 2005; Gobet & Campitelli, 2007). In a classical study, Simon and Chase (1973) estimated that it takes about ten years of intensive practice to become an expert in chess. Nevertheless, there seems to be substantial variability in the number of practice hours among skilled players (Gobet & Campitelli, 2007). Thus, domain-specific practice is necessary, but not sufficient, to acquire an expert-level. As in reading, it is likely that the success of practice depends on the preceding level of understanding and on the way, practice is substantiated. It is interesting in this light that it has been shown recently that there is a speeding-up in the time to reach high levels of expertise (Gobet & Campitelli, 2007), i.e., the amount of young chess grandmasters has augmented significantly during the last decade. Changes in training methods, particularly the emergence of computerized databases, might be the cause of this phenomenon (Gobet & Campitelli, 2007). Computerized databases facilitate repetitive exposure to relevant positional configurations and, by that, provide opportunities to feed the instant recognition repertoire of frequent chess situations.

A recent review by Gobet and Jansen (2006), in which various training techniques are compared, sheds further light on the dynamics of successful practice in chess. Gobet and Jansen infer several educational principles from their findings which must result in the emergence of chunks and templates, viz, the elements to be learned must be clearly identified, complexity must increase gradually, the focus must be limited constantly to a small number of positions at a time, vast repetition is vital, resources must be employed efficiently, specific attention must be given to typical situations, and motivation must be maintained for long periods.

Recall that Wood et al. (2001) stressed the additional importance of anticipatory processing in reading. Again there seems to be an analogy in chess, in two experiments, Ferrari, Didierjean, and Marmèche (2006) highlighted the anticipatory component of expert perception in chess.

In conclusion, there are similarities between the development of skilled reading and the development of expert chess playing, both on a neurological level and on a behavioral level. Therefore, it is no surprise that within both areas of research, conclusions about the dynamics that lead to high proficiency, coincide.

NEW DIRECTIONS FOR TREATMENT

The aim of the current chapter is to contribute to the quest for educational principles that could enhance reading fluency in the reading disabled. After having focused on the dynamics of reading fluency from a behavioral perspective as well as from a neuroscientific perspective, what conclusions can we draw concerning fluency-oriented instructional practices? In the current section we will try to answer this question by integrating various insights from the preceding sections. In addition, some promising new directions for dyslexia treatment will be proposed. We will end this section by presenting a software program, called LexyLink, which we developed in our own laboratory and which we consider as an example of an innovative fluency-oriented approach.

Educational Principles

There is general agreement that in order to become a skilled reader the slow and laborious reading that marks the initial phase, must be substituted somewhere in time, by instant recognition of words (Ehri, 2002; Torgesen & Hudson, 2006; Share, 1995). In alphabetical scripts, such as English, Dutch, Korean, and Russian, the mastery of grapheme-phoneme correspondences is a key aspect in reading acquisition (Atteveldt, Formisano, Goebel, & Blomert, 2004; Sprenger-Charolles et al., 2006). Familiarity at this fundamental level could pave the way for subsequent learning of phonemic and orthographic regularities (Chall, 1996; Share, 2004). However, it is noted that full automaticity of grapheme-phoneme associations in the sense that they become instrumental in fluent reading takes much longer than the acquisition of passive knowledge of them (Blomert, 2005; Froyen, Bonte, van Atteveldt & Blomert, in press; Sprenger-Charolles et al., 2006). Knowing the associations between letters and speech sounds appears to be only the starting point of the development toward automatic letter-speech sound integration (Froyen et al., in press). In our opinion, it is therefore essential to train grapheme-phoneme correspondences vastly in dyslexics. Traditional approaches are less appropriate for this purpose, because they lack the needed intentionality and do not account for the time demands associated with audiovisual letter integration. Several neurofunctional studies demonstrated that the integration of speech and visual stimuli takes place within a very brief time window (e.g., Froyen et al., in press; Raij et al., 2000). Consequently, we advocate massive and intentional repetitive training of grapheme-phoneme correspondences, considering the required time demands. The aim of this training should be a neural tuning process, which takes the mastery of these correspondences to a higher level.

Another step in the pursuit of an instant recognition repertoire in reading seems to be the set up of a strong foundation of explicit knowledge of phonemic and orthographic regularities, as well as the unfolding of powerful decoding skills. High levels of familiarity within these domains in combination with increasing experience are considered to act as a bootstrapping mechanism for the subsequent tuning towards an instant recognition repertoire. As we saw in the preceding sections, this view is strongly supported by cognitive (Chall, 1996; Ehri, 2002; Share, 1995; Siegler, 1995; Sprenger-Charolles et al., 2006), neurobiological (McCandliss & Nobel., 2003; Pugh et al., 2001; Schlaggar & McCandliss,

2007), and connectionist (Harm, McCandliss, & Seidenberg, 2003; Harm & Seidenberg, 1999; Seidenberg, 2005; Seidenberg & McClelland, 1989) models of reading acquisition, and shows striking parallels with other areas of expert proficiency. The notion of bootstrapping is further supported by the finding that the enhanced accuracy leads to further development of reading rate after specialized phonology based treatment (Tijms, 2007).

The problem in the case of dyslexia is that dyslexics will not capitalize on experience as long as their decoding skills fall short. Consequently, at the time dyslexics start to take advantage of reading experience they have to make up for the huge deficits in reading practice they have accumulated over time. An enormous amount of experience is needed to close this gap, which is additionally hindered by the fact that dyslexics have a limited inclination to engage in reading (Torgesen, 2005). Experimental studies confirm that dyslexics need much more exposure and repetition in order to learn words by sight (Hintikka et al., 2008; Reitsma, 1983; Thaler et al., 2004).

Ehri (2002) argues that some “mnemonically powerful” system must be responsible for learning words by sight. It is plausible that on a neurobiological level this system is embodied by the putative VWFA. The responsivity of this area grows with increased experience (Vinckier et al., 2007), which seems to be a relatively slow process. Accordingly, there is general agreement on that reading fluency only emerges after extensive reading experience (Kuhn & Stahl, 2003; Nathan & Stanovich, 1991; Torgesen 2005; Torgesen & Hudson, 2006). This is also in line with findings from other areas of expert learning where different authors concluded that it takes about ten years to become an expert within a given domain (Ericsson, Krampe, & Tesch-Römer, 1993; Simon & Chase, 1973).

So how should extensive practice be arranged in order to be successful in enhancing the reading fluency of dyslexics? Again, we propose massive and intentional repetitive training of correspondences between sounds and their graphic representations in scripts, including whole words, but rather than to close the gap after traditional intervention has been completed, we argue that this repetitive exposure should take place simultaneously. Thus, instead of letting experience do its job after general accuracy is restored by explicit intervention, we propose an organization in which every explicit instruction will be elaborated by additional intentional boosting. By this means one can start building on the instant recognition repertoire right away, because every single achievement on an explicit level will be exploited immediately to bring about automatization. This idea is reconcilable with Share’s idea of item based development, in which for some words the reader must rely heavily on effortful decoding, while other words are already processed automatically (Share, 1995). Wood et al. (2001) also plead for fluency training as a background for phonology based training rather than as an “add-on” after phonology based training has been accomplished.

Within this proposal it is important that the used material, as well as the presentation order, is selected carefully. As stated before, the initial focus must lie on isolated phonemes. Then, the attention can slowly be shifted to increasingly larger word fragments and ultimately whole words, mirroring the natural development of the VWFA and its hierarchical organization. The earlier mentioned findings of Hintikka and colleagues (2008), in which they found that flashcards training was more effective when sub-lexical units were used as target instead of words, are interesting in this light. When using whole words finally, we argue that it is preferable to use real words instead of pseudowords, to nourish the goal-directedness in learning, as advocated by both Wood and colleagues (2001) and Usacheva and colleagues (2007). For the same reason it is good to emphasize the purpose of learning frequently and to

invite the pupil to think ahead. Of course, much of this can be done during the phase of explicit instruction. On the other hand postponing a semantic context could be beneficial particularly in the initial phase, because, as stated earlier, it allows the readers' attention to be drawn away from word decoding (Landi et al., 2006).

On a neurobiological level building an instant recognition repertoire can be seen as an increasing tuning of neurons for script based stimuli, as a consequence of repeated exposure (Vinckier et al., 2007; Wood, Flowers, and Grigorenko, 2001). Mahncke, Bronstone, and Merzenich, (2006) describe this as the strengthening of the signal-to-noise ratio of relevant cortical activity. Naturally this kind of learning proceeds on the basis of distributional information, without directed attempts to learn, and without requiring teaching signals (Munakata & Pfaffly, 2004). Consequently, we propose that fluency training should comprise a more implicit associative form of learning in which this neuronal tuning process is facilitated.

Another important issue is the scheduling of the training sessions. Capitalizing on the malleability of the brain requires a substantial training schedule in which the desired skill must be practiced over hundreds of times (Mahncke, Bronstone, & Merzenich, 2006). Furthermore, continuity must be preserved by limiting inter-session interval time, i.e., Thaler and colleagues (2004) found that within fluency training, the weekend break already led to a slight decrease in reading speed.

Summarizing, we propose a training paradigm aimed at enhancing reading fluency, in which associative learning by massive exposure to phonemes, both isolated and as a part of word fragments and whole words, is combined with traditional explicit intervention methods. In the following paragraph we will argue that edugames offer a promising framework for realizing our suggested educational goals.

The Unique Possibilities of Edugames

Edugames are computer programs, which are designed for teaching certain skills. They provide unique possibilities to educators because learning dynamics can be controlled automatically and motivation can be brought off for prolonged periods of time. Moreover, computer aided instruction is low-cost in modern society and can be easily applied in different settings, such as school or home.

On a cognitive level edugames are advantageous because the learning dynamics can easily adapted to the pupils needs. The complexity of the educational contents for example, can be maintained within the "zone of proximal development", providing an optimal level of cognitive stimulation and minimizing failure (Wilson et al., 2006). If the game is designed in such a way that educational aspirations coincide with game objectives, a form of implicit learning arises which is highly effective.

For our specific purposes the edugame paradigm is particularly suitable because it offers the possibility to establish massiveness of exposure, within a highly motivational environment. Notably, when it is aimed to expose subjects many hundreds of times to more or less the same stimuli, they must be willing to play the game, preferably without asking them. However, if properly designed, computer games are highly motivational because they meet the universal criteria of enjoyableness (Johnson & Wiles, 2003). In an extensive study Csikszentmihalyi (1990) explored the characteristics of enjoyableness and concluded that we

are inclined to engage in an activity if it can be completed, demands concentration, has clear goals, provides immediate feedback, leads to a sense of control, demands a deep involvement that removes awareness of every day life frustrations, leads to a lack of concern for self, and alters the sense of time. Mahncke, Bronstone, and Merzenich, (2006) take the concept of motivation somewhat further and argue that from a neurobiological point of view arousal, attention, reward, and novelty must be capitalized, because the associated release of specific neurotransmitters can strengthen learning and memory. Again, edugames can be particularly appropriate to meet these goals.

Another advantage of edugames is that it is relatively easy to integrate specific time demands. There are various possibilities, such as timekeepers, time bonuses, and time limits, to encourage subjects to respond quickly. This aspect is also significant within our proposal, because time demands are needed to ensure high exposure frequency within a short period, and to respect the time course that is associated with audiovisual letter integration.

Edugames have been applied successfully in several domains, among which: dyscalculia (Wilson et al., 2006), specific language impairment (Merzenich et al., 1996), and aging (Mahncke et al., 2006). The open-source software “The Number Race”, designed for remediation of dyscalculia, is an interesting example of an adaptive edugame in which repeated exposure is used for strengthening the links between representations of number (Wilson et al., 2006). The authors used a multidimensional learning algorithm, containing the dimensions numerical distance, speed, and conceptual complexity, to constantly adapt the difficulty of the program to the child’s performance level. The speed dimension was implemented to increase automaticity.

A game that is specifically designed for dyslexia prevention and which is based on repetitive exposure to grapheme-phoneme associations is the “Graphogame” (Richardson, 2008). The game’s aim at neural tuning fits with our educational propositions. However, as opposed to our suggestions, the “Graphogame” does not combine this implicit method with traditional explicit approaches. The effectiveness of this game is currently under investigation in four European countries.

We will end this section by presenting LexyLink, an edugame developed in our laboratory with the aim of substantiating our educational propositions.

An Innovative Approach: LexyLink

The theoretical issues, discussed earlier in this chapter, inspired us to set up a project on the development and implementation of more elaborate associative learning mechanisms in an existing treatment program for dyslexia, called LEXY (see Tijms, 2005 for a detailed description of the program). This traditional computer based treatment presents dyslexic pupils with a learning system clarifying the basic linguistic elements and operations that are essential for the graphic representation of spoken language and guides the recognition and use of the phonological and morphological structure of Dutch words.

It was shown that this treatment results in clinically relevant improvements in reading and spelling, i.e., for text reading accuracy and spelling, most of the participants attained a level of proficiency equal to, or above, the normative average for these skills (Tijms, 2005). In concordance with general findings, one notable result is that reading rate is less susceptible to intervention than reading accuracy. Therefore, by implementing a complementary edugame

in the treatment program, we aim to accelerate reading rate as a fundamental aspect of reading fluency.

In this project dyslexic pupils attending the LEXY program will be presented with a complementary software program, called LexyLink, which has an implicit foundation. This software consists of a challenging computer game in which the pupil has to match sounds to their corresponding graphic representations. Correct associations lead to success in the game, while incorrect associations jeopardize a positive outcome. Fast playing is reinforced by progressive time restrictions and by giving time bonuses.

The design of the software was based on the aforementioned educational principles. Through this game pupils will be massively exposed to associations between sounds and their graphic representations. The specific contents of LexyLink will be matched consistently with the ingredients from the preceding LEXY session. Consequently, any explicit lesson is followed by an extensive associative elaboration of its contents. By enhancing the pupils' explicit knowledge and decoding skills in advance, full advantage can be taken of the intentional massive exposure. An illustration of a Dutch word that could be the target of explicit instruction is "sla" (lettuce), which is pronounced as /s_laa/. Since the long vowel ends the syllable, it is written with one graph. By contrast, in the word "slaap" (sleep), which is pronounced as /s_laap/, the long vowel /aa/ has its standard representation comprising two graphs. In LexyLink this specific rule can be easily practiced in a more associative implicit fashion. For example, the subject hears the phoneme /aa/ and has to shoot it against a word, inside a balloon, that contains the phoneme in question, for example the word "sla" or "slaap". However, some balloons contain distractor words, which lack the phoneme in question, but share some graphic similarities, for example the word "slap" (weak), which is pronounced as /s_lap/ and thus contains a short vowel /a/ instead of a long one. So, the treatment is organized in a way that mimics the putative bootstrapping mechanism, discussed earlier, and that facilitates neural tuning.

The fact that LexyLink aims to expose dyslexics massively to the associations between sounds and their graphic representations, places high demands on the attractiveness of the game, because obviously massive exposure can only occur if the child is willing to play frequently. Therefore much attention is given to the enjoyableness of the game. Importantly, the basic associative principle of the game is enjoyable by itself because it meets Csikszentmihalyi's (1990) criteria. Nevertheless, we added some external motivational components to ensure maximum engagement, such as time bonuses, rewards for accomplishing levels, and a high score list. However, we avoided decorative motivational elements, like additional images and funny noises, because these make an unnecessary appeal on cognitive resources.

After a period of treatment we will investigate the additional effectiveness of LexyLink as a complementary module. The effect on reading fluency will have our special attention.

Summarizing, we aim to accelerate the growth of reading fluency by boosting the development of instrumental grapheme-phoneme associations within a computer game environment.

CONCLUSION

In this chapter we engaged in a theoretical quest for ways to ameliorate reading fluency in dyslexics. We started by giving an overview of research regarding fluent reading and disrupted reading, with special attention for state of the art findings from cognitive neuroscience.

Amalgamating insights from cognitive, neurobiological, and connectionist models, as well as from the paradigm of expert learning, we drew several conclusions regarding fluency-oriented instructional practices and proposed some new directions for dyslexia treatment. Our proposals can be summarized in the following way:

- *Nourish familiarity of grapheme-phoneme correspondences:* The mastery of grapheme-phoneme correspondences is a key aspect in reading acquisition. Familiarity at this fundamental level could pave the way for subsequent learning of phonemic and orthographic regularities. We advocate massive and intentional repetitive training of grapheme-phoneme correspondences. This training must continue until these correspondences are really well anchored in the brain.
- *Start building on the instant recognition repertoire right away:* Dyslexics will not capitalize on experience as long as their decoding skills fall short. We propose massive and intentional repetitive training of correspondences between sounds and their graphic representations in scripts, including whole words, but rather than to close the gap after traditional intervention has been completed, we argue that this repetitive exposure should take place simultaneously, i.e., every explicit instruction should be elaborated by additional boosting.
- *Focus on increasingly larger word fragments:* It is important that the used material, as well as the presentation order, is selected carefully. The initial focus must lie on isolated phonemes. Then, the focus should slowly be shifted to increasingly larger word fragments and ultimately whole words, mirroring the hierarchical organization of the VWFA.
- *Invite for anticipatory processing:* We argue that it is preferable to use real words instead of pseudowords, to account for goal-directedness in learning. It is important to emphasize the purpose of learning frequently and to invite the pupil to think ahead. In the end fluent reading is characterized by integrative and anticipatory processing.
- *Control the time frame:* Capitalizing on the malleability of the brain requires a substantial training schedule in which the desired skill must be practiced over hundreds of times. Furthermore, continuity must be preserved by limiting inter-session interval. The integration of speech and visual stimuli takes place within a very brief time window. Therefore, time demands should be taken in consideration.
- *Capitalize on educational software:* Edugames provide unique possibilities to educators because learning dynamics can be controlled automatically and motivation can be brought off for prolonged periods of time. Moreover, within edugames our proposed educational principles can be effectively substantiated. From a neurobiological point of view edugames provide a way of capitalizing on the release

of specific neurotransmitters which are associated with arousal, attention, reward, and novelty, and which strengthen learning.

In an attempt to contribute one's mite to the fluency quest we substantiated our proposed educational principles in an edugame, called LexyLink, which we developed in our laboratory. This edugame is designed as a complementary module to a traditional treatment program for dyslexia, with the intention to enhance reading fluency. The efficacy of LexyLink is currently under investigation. We hope to report on the outcomes of this research project soon.

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Chapter 4

CULTURAL INFLUENCES ON THE LEARNING OF SCIENCE: AN AFRICAN PERSPECTIVE

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ABSTRACT

In many developing countries in Africa, learners' cultural background seems to be one of the major factors that militate against their learning of formal science in schools. On many occasions, the stakeholders in education attribute poor performance in science to bad teaching, the difficulty and the abstractness of science. What they fail to address, however, are the circumstances of the learners, which are mainly cultural. The influence of culture on the learning of science in schools should be addressed seriously by teachers, parents and educational planners. Culture has the categories of beliefs, practices, behaviour, communication skills, values and attitudes. This chapter presents empirical studies on the influence of culture on the learning of science in primary and secondary schools in Kenya. The chapter is divided into three major sections. Section one examines the manifestations of cultural influence on the learning of primary science in schools in four cultural communities in Kenya, the Maasai and Kipsigis of the Rift Valley province, and the Abagusii and Luo of Nyanza province. Section two is about the influence of cultural beliefs in the form of metaphors concerning "heat" in form three students' explanations of everyday life experiences in Nyandarua district. Section three examines the influence of the Bukusu culture of Bungoma district, on students' conceptions of the topic "nutrition" in secondary school biology. The chapter concludes with a discussion on the challenges this poses to science education in Africa.

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1.0. INTRODUCTION

In modern society science education plays a significant role in the socio-economic development of a nation. Scientific knowledge has become a crucial factor in the production of wealth and is seen as a panacea of a number of societal problems. A UNESCO world conference on science in Budapest, Hungary declared that science should be at the service of humanity as a whole and contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations (UNESCO, 1999). Science education curricular in Africa, therefore, should aim at equipping learners with a broad based scientific knowledge, develop the skills used in the scientific enterprise, help learners acquire an inquisitive mind and also emphasize the relationship between science education and society. Newton (1988) argues that science education should provide enough understanding of the place of science in society to enable the great majority that will not be actively engaged in scientific pursuits to collaborate intelligently with those that are and be able to criticize or appreciate the contributions of science and technology. Broad access to scientific information is key for people to actively participate and respond to challenges posed to development (De la Rosa, 2000) This, therefore, calls for effective teaching and learning of science, more particularly in the primary and secondary schools.

However, there are a number of factors that are militating against the teaching and learning of science in Africa. Evidence emerging from empirical studies suggest that culture is one of the major militating factors (Shumba, 1995; Ananuah-Mensah, 1998, Okere and Keraro, 2002). Critics of education systems in Africa attribute the poor state of science education to bad teaching due to a large number of unqualified or under-qualified science teachers, abstractness of science and lack of teaching-learning facilities. What is not addressed is the circumstances of learners that are largely shaped by their cultural environment. This, therefore, brings us to the question; what is culture and how does it become significant in the learning of formal science?

1.1. CULTURE

The term culture has been defined in different ways by different people. Ogunniyi (1989) has given a detailed historical account of the origins of the concept culture and associates it with Edward B Taylor in 1871 who used it to refer to civilization. Culture in a general sense refers to patterns of human activity and the symbolic structures that give such activity significance (Wikipedia, 2007). The attributes that define culture would, therefore, include language, customs, morals, institutions, knowledge, ideas, beliefs and belief systems. Culture can also be interpreted to mean a worldview. A worldview shapes how people perceive, understand and interpret natural phenomena and all other events in their environment.

According to Ogunniyi (1989), traditional African culture relates to the organized body of knowledge, beliefs, values, customs, conventions, routines, social institutions and away of life essentially African in origin, development and orientation and which are usually passed by word of mouth or by example from one generation to another. In this chapter, the term culture is defined as an established way of life or social heritage of a people. It constitutes all

those socially transmitted results of human experience through which a group of people carries its way of life. It includes language, customs, morals, tools, institutions, knowledge, ideals and standards.

1.2. SIGNIFICANCE OF CULTURE IN THE LEARNING OF SCIENCE

Atwater (1994) points out that culture is an important aspect of a child's development. It is a strong designer of human nature, experiences and their interpretations. It is also acknowledged that a child's conceptual development is a function of several factors including his/her socio-cultural background, mental maturity and the learning environment (Ogunniyi, 1985). By the time African children are of school going age, they have a repertoire of cultural beliefs, myths and explanations for natural phenomena. They have also been exposed to and participated in various cultural practices such as traditional rites. Some of the cultural practices and indigenous knowledge that African children are exposed to may be at variance with conventional/formal science. These socio-cultural predispositions, therefore, make a significant contribution to the learning of formal science.

Odhiambo (1972) and Ogunniyi (1988) assert that since modern science is a product of Western culture, it may not be easily amenable to the African worldview. Worldview as already indicated shapes how people perceive, understand and interpret phenomena because their culture of origin conceptions come into play. In non-Western societies, it is increasingly becoming clear that understanding the contribution of culture's worldview is significant to adoption of science, its method and values (Ogawa, 1986; Cobern, 1993). Cobern argues that in developing countries there is need to ask "questions about worldview and the compatibility of various non-Western worldviews with modern science." Morris (1983) argues that education does not take place in a vacuum; it occurs against the background of a view of the world and society. Students come into a classroom with their own experiences and a knowledge base on these experiences. A student will reformulate his/her existing cognitive structure only if new information or experiences are linked to the knowledge within his/her cognitive structure. Inferences, elaborations and relationships between old perceptions and new ideas must be personally drawn by the student for the new idea to become integrated to his/her mental schema. Science must then be studied in relation to socio-cultural variables and traditional worldviews if integration of traditional worldview and scientific worldview is to take place (Solomon, 1991). According to Zietsman and Naidoo (1997) not all students' preconceptions are misconceptions. In some cases these preconceptions are adaptive and useful for dealing with the physical world and are largely in agreement with the accepted scientific theories. The prior knowledge structures act both as filters and facilitators of new ideas and experiences and themselves may become transformed during learning. Lynch (1996) observed that in a society that is much closer to subsistence demands, it is not surprising that the notion of worldview will incorporate the cultural values revolving around the social and physical environment of the society. Hewson and Hamlyn (1984) argue that the 'ecological context of knowledge' in a non-Western setting may result in conceptions in science that work for the student (in terms of making sense of his/her world) but which are not in accord with conventional science. It has also been pointed out that African

communities, and more particularly those in rural areas often hold deep rooted traditional beliefs about certain things which in some cases do not conform to accepted scientific explanations (Gray, 1998).

Gilbert and Watts (1982) suggest that if a learner is to be viewed in terms of conceptual change or development it is of more value to understand more about the evolution of students' ideas with their intellectual development. According to Petrie (1976), conceptions exist in a dynamic interaction between culture and social beliefs of the society; the prevailing paradigms or theories; and the input from the facts and events of the natural world. Concept formation is interpreted according to the varied mental setting of individuals, which are a function of their intellectual and natural environment.

According to Shumba (1995) conflict between indigenous cultures and science culture can arise in part in science lessons because some science topics might be taboo to certain cultures and, therefore, learners. For instance in some communities in Zimbabwe handling bones or creatures such as mice, owls and other nocturnal animals is a taboo tied to a belief in the practice of witchcraft. Indeed, this position obtains in many other African communities. This conflict in understanding and interpretation thus becomes significant for learners learning science within an African context.

Horton (1967), UNESCO (1986) and Ogunniyi (1989) identify some of the main features that define African cultures. These include:

- A propensity for positing cause and effects relationship between events without proof
- Bringing up children in a manner that makes them passive. They are not allowed to question their elders as this amounts to challenging established authority.
- Stress of oral traditional and rote learning without variation.
- A strong belief that natural forces and/objects of the Universe are controlled by spirits.
- Protection of "theories" even when they fail to agree with observations made

All the above features of the African cultures totally contradict the fundamentals of the Scientific method and the status of scientific knowledge as envisaged in the philosophy of science. Cultural factors are, therefore, likely to militate against the learning of formal science within the African context. The empirical studies presented in sections one, two and three are examples of the manifestations of the influence of cultural factors in the learning of science in the African context with specific examples from Kenyan cultural communities.

SECTION ONE: MANIFESTATIONS OF CULTURAL INFLUENCE IN THE LEARNING OF PRIMARY SCIENCE: A KENYAN EXPERIENCE

To find out how cultural influence manifests itself in the learning of primary science, a study was carried out in eight rural primary schools from four cultural communities in Kenya, the Maasai and Kipsigis of the Rift Valley province and the Abagusii and Luo of Nyanza province. The purpose of this study was to investigate and bring into focus cultural factors that influence the learning of science in the primary schools. The major objective was to

establish learners' explanations for natural phenomena and the sources of these explanations. To realize this objective, two instruments, namely a questionnaire and interview schedule were used. The two instruments essentially carried similar items and required respondents to give their explanations for selected phenomena. The focus was on:

- Reproduction (in both plants and animals).
- Determination of the sex of a child.
- Natural events associated with specific animal sounds (e.g. Owl).
- Causes of lightening.
- Causes of blindness in new born babies.
- Causes of mental illness.
- Diseases and other causes of death.
- Forces.
- Causes of drought.
- Formation of rain.

The questionnaire was administered on 196 grade eight learners sampled in 8 rural primary schools from four cultural communities (2 schools in each community). The grade eight was purposively selected because it is the final grade in the Kenyan Primary School cycle and hence learners in this grade have had the longest exposure to formal science at this level. The aim of interviews was two fold. First to give learners an opportunity to elaborate on their explanations for the selected phenomena and secondly to find out whether these explanations are in anyway related to cultural or traditional explanations in the respective communities. To this end, a total of 32 learners, 8 from each cultural community were interviewed. 8 community elders, (2 from each group) who were well versed on their respective cultural practices and indigenous knowledge were also interviewed. Whereas the learners who were interviewed were selected by stratified simply random sampling, the community elders were purposively selected.

RESULTS

A. Questionnaire Responses:

The natural phenomena that were presented to learners in this study are of common occurrence in their environment and are also covered in the primary school science curriculum. The explanations that were given by the learners are in three categories

- Explanations based on acceptable scientific ideas (scientifically valid).
- Explanations that have some elements of acceptable scientific ideas.
- Explanations that do not have any scientific ideas on respective phenomena (misconceptions).

The results show that learners held a wide range of misconceptions on all the phenomena which were presented in this study to varying degrees. The phenomena are common among

all the cultural communities included in the study sample. The following examples help to illustrate this point.

I. The Period of Conception in a Woman

A good number of pupils from all the cultural communities did not understand the most likely period of conception in a woman. Most of them believed that conception is likely to take place when a woman is having her periods or any time she has sexual intercourse. The percentage of learners who gave this misconception varied from 62.5% to 82.5% in the four cultural groups. It is significant to understand that the concept of reproduction in mammals is introduced in grade 6 and later covered in grade 8.

It is disturbing to realize that the main source of the learners' misconceptions on the period of conception was identified as science teachers (28.6 to 55%). The other sources were grandparents and parents and this was consistent across the four cultural groups. Cultural norms in most African traditional communities forbid discussions on sex openly between adults and children. In addition, explanations often given in such cases are aimed at discouraging children from engaging in premarital sex. This perhaps explains why a large number of the pupils did not understand the likely period of conception. It would appear that even teachers are not free to discuss it in their science lessons due to the cultural impediments. In such a scenario, misconceptions will continue to be perpetuated.

II. Causes of Lightning

It was found in this study that learners held a wide range of misconceptions on the causes of lightning which are based on magical powers or superstition (70%-73.6%).

Example:

- Lightning is caused by angry ancestors.
- Lightning is attracted by red garments worn when it is raining.
- Lightning is a punishment for those who commit crimes in society.
- Lightning is caused by a red cock or bird.

Unlike the likely period of conception in a woman, the main sources of misconceptions on lightning were found to be outside the school environment. Grandparents, parents and siblings are the major sources.

III. Causes of Blindness in New Born Babies

Responses to this item on the learners' questionnaire also fall in the three broad categories:

- Explanations based on acceptable scientific ideas (valid scientific explanations).
- Explanations with elements of acceptable scientific ideas (partially correct).
- Explanations based on taboos and superstition (misconceptions).

The following responses are examples in each of the three categories.

Scientifically Valid Explanations

- Mothers lacked a balanced diet when pregnant.

- Mother and/or babies got infected during pregnancy.
- Mothers used illicit drugs when pregnant.
- The babies born as pre-matures.

On the whole, 47.3% of the 196 learners sampled gave responses in this category.

Explanations Based on Limited Scientific Evidence (Partially Correct)

- Blindness in new born babies is inherited.
- Mothers overworked when pregnant.
- Mothers had a problem when giving birth.
- Mothers lacked physical exercises when pregnant.
- Mothers failed to attend clinic when pregnant.

Responses in this category accounted for 8.6%.

Explanations Based on Taboos and Superstition (Misconceptions)

- Mothers ate prohibited foods when pregnant e.g eggs.
- Baby did not have 'exact' father (born out of wedlock).
- It is God's wish.
- It is a punishment/curse for parents who commit crimes in society.

Explanations in this last category seem largely to suggest that if a cultural norm is contravened the culprits may bear a blind child as a consequence. Misconceptions represented 44.1% of the learners' responses on this item. Once again, the main source of the learners' misconceptions were outside the school environment.

All the three examples provide evidence of cultural factors manifesting themselves in learners explanations for natural phenomena. These findings strongly suggest that learners misconceptions are culturally determined, more particularly in cases where cultural interpretations are at variance with formal science.

B. Interviews

The results of the interviews with learners were consistent with those obtained from the questionnaire. On a whole, their explanations fell into the three categories already discussed. The interviews with the elders who are more informed on cultural practices and indigenous knowledge did confirm that the misconceptions held by learners are derived from cultural practices and interpretations of phenomena. It is, however, important to note that some of the cultural explanations conform to conventional science. Tables 1-4 present results of the interviews with learners and elders from the four cultural communities included in the study. More information on this study can be found in Keraro (2002).

Table 1. Explanations for selected natural phenomena given by Kipsigis pupils and experts on culture

Phenomena	Pupils' explanations	Explanations by experts on culture
1) Natural events/occurrences associated with stars/the sky.	-If the sky is covered by a lot of clouds, then the rains are about to come. -Too many stars in the sky is a sign of drought.	-When there are only a few stars in the sky then, it is about to rain. - A clear sky signifies the coming of a dry season.
2) Natural occurrences associated with specific animals/animal sounds. -Noise made by an owl. -A jackal. -Noise made by 'getutunye' (a type of bird).	-Signals death in a village. -None given. -The rain season is about to come.	-It is crying for somebody's blood, a person will die in the village. -If it crosses your path, then the journey is not safe. -The rain season is about to come.
3) Causes of drought.	-Social evils in society. -Removal of forest cover -Appearance of a large flock of birds flying in one direction.	-Social evils e.g mistreating strangers. -Excessive removal of forest cover. -God's wish.
4) Responsibilities of a rainmaker.	-The 'laibon' who call rain perform rituals and pray for the rains to come. -Advice people on when it will rain.	-The 'laibon' who make rain/ perform rituals that end the drought.
5) Stopping of a hail storm.	-Place a cooking stick outside when it starts falling. -Throw a silver coin and ashes outside when it starts falling.	-Take the stick used to clean the milk guard, scoop some ashes from the fire place and throw outside. (some specific words are uttered in the process). -Throw a silver coin outside as it starts falling.
6) Causes of lightning	-Carrying red objects or sharp objects or wearing red clothes when it is raining. -Meeting of cold air currents and warm air currents when it is raining. -Carrying a mirror when it is raining. -Sheltering under a tree when it is raining.	-Social evils in society -A curse -A lizard (Agama agama) which is commonly found on trees or rocks. -Red clothes attract lightning. -A mirror that is not covered attracts it.

Phenomena	Pupils' explanations	Explanations by experts on culture
7) Prevention of lightning.	<ul style="list-style-type: none"> -Avoid standing/walking in surface run- off when it is raining. -Avoid carrying red objects or wearing red clothes when it is raining. -Avoid playing making or noise when it is raining. 	<ul style="list-style-type: none"> -Certain rituals are performed to prevent a repeat strike. -Avoid wearing red clothes.
8) Getting a child of desired sex.	<ul style="list-style-type: none"> - Pray to God. -- Traditional medicine administered by a medicine woman to a mother before she conceives. 	<ul style="list-style-type: none"> - Traditional medicine administered by a medicine woman to a mother before she conceives.
9) Causes of blindness in new born babies.	<ul style="list-style-type: none"> -Parents had an STD infection. -It is inherited. -Witchcraft. -It is God's wish. 	<ul style="list-style-type: none"> -Is a result of a curse -Social evils committed by parents -It is God's wish. -Father may have killed some animals when the wife was pregnant.
10) Causes of madness.	<ul style="list-style-type: none"> -Too much reading/studying. -Too much thinking about problems. -It is inherited. -Witchcraft. 	<ul style="list-style-type: none"> -Physical damage of the brain. -Too much thinking/stress. -It is inherited. -A result of a curse. -Too much use of illicit drugs.
11) Causes of disease and death.	<ul style="list-style-type: none"> -Dirty environment -Dirty food. -Parasitic organisms e.g. mosquitoes. 	<ul style="list-style-type: none"> -Some illnesses come naturally. -Witchcraft. -It is God's wish. -Death at old age is natural.

Table 2. Explanations for selected natural phenomena given by Abagusii pupils and experts on culture

Phenomena	Pupils' explanations	Explanations by experts on culture
i) Natural events/occurrences associated with stars/the sky	<ul style="list-style-type: none"> -Stars give light -If the sky is dark, then it is about to rain. -A cluster of stars (fire flies) on the ground is a bad omen: - the children may die or one who meets them may never have any children. 	<ul style="list-style-type: none"> -If a ring forms on the sky during the day then a prominent person would have died. - A cluster of stars (fire flies) on the ground is a bad omen. A sacrifice has to be offered to appease the ancestors.
2). Natural events occurrences associated with specific animals/ animal sounds. -Noise made by an owl. -'Enyamuchera' (a small black bird with white plumage on the chest).	<ul style="list-style-type: none"> -Signals death in a village. -None given. 	<ul style="list-style-type: none"> -Signals death in a village. -If it perches on a tree and gives you its back while on a journey , then the journey is not safe.
3) Causes of drought.	<ul style="list-style-type: none"> - It is a season that has to come. - Removal of forest cover. - The appearance of many locusts is a sign of drought 	<ul style="list-style-type: none"> -Social evils. -If the rainmakers are not well treated. -Removal of natural vegetation.
4) Responsibilities of rainmakers.	<ul style="list-style-type: none"> -They make rain. -They dance `ribina' and perform rituals and the rain comes. 	<ul style="list-style-type: none"> -They bring about rain. -Perform rituals dance `ribina' (a dance for rain) so that rain can come.
5) Stopping of a hail storm .	<ul style="list-style-type: none"> -Throw a cooking stick outside when it starts falling. -Throw an axe, a five shilling coin and ash outside when it starts falling (some specific words are uttered in the process.) -Throw a glass bottle together with ash outside when it starts falling. -Throw some of the hail stones on fire and throw a glass bottle outside. 	<ul style="list-style-type: none"> -Throw a cooking stick and silver coin outside when it starts falling. -Pick some hailstones, throw some of them on fire, mix the others with ash and throw them outside. -Place a hoe outside and a silver coin once it starts falling.
6) Causes of lightning.	<ul style="list-style-type: none"> -Meeting of warm air currents and cold air currents when it is raining. -Attracted by red clothes and sharp objects. -Carrying of sharp objects pointing upwards. -Making noise when it is raining -A red cock. -Sheltering under trees. 	<ul style="list-style-type: none"> -A small red bird called `enkoba' (lightning). -Wearing red clothes. -Failure to appease the ancestors.

Phenomena	Pupils' explanations	Explanations by experts on culture
7) Prevention of lightning.	<ul style="list-style-type: none"> Put some arrows on the roof (lightning arresters). -Place sharp objects to point downwards.. -Avoid wearing red clothes when it is raining -Avoid walking in surface runoff. -Avoid making noise when it is raining. -Avoid sheltering under trees. 	<ul style="list-style-type: none"> - It cannot be stopped or prevented.
8) Getting a child of desired sex.	<ul style="list-style-type: none"> - Traditional medicine is administered on a mother by a medicine woman before conceiving. 	<ul style="list-style-type: none"> - Traditional medicine is administered to a mother by a medicine woman before conceiving.
9) Causes of blindness in new born babies.	<ul style="list-style-type: none"> -Mother lacked a balance diet when pregnant -Mother got infected by an STD when pregnant. -Either the mother or both parents were cursed. 	<ul style="list-style-type: none"> -A curse due to the parents social evils. -It is God's wish.
10) Causes of madness.	<ul style="list-style-type: none"> - Thinking too much about problems (stress). - Brain damage/brain disease. -Studying too much. Witchcraft. 	<ul style="list-style-type: none"> -Too much use of illicit drugs. -It is inherited. Too much reading/studying. -Physical damage of the brain.
11) Causes of disease and death.	<ul style="list-style-type: none"> -Dirty environment. -Dirty food. -Parasitic organisms e.g mosquitoes- -Witchcraft. 	<ul style="list-style-type: none"> -Diseases. -God created diseases and death. Witchcraft.

Table 3. Explanations for selected natural phenomena given by Luo pupils and experts on culture

Phenomena	Pupils' explanations	Explanations by experts on culture
1) Natural events/occurrences associated with stars/the sky.	-Dark clouds in the sky indicate the coming of a rain season. -Many stars in the sky indicate the coming of a dry spell (drought).	-There are specific stars that indicate the coming of a rain season and good harvest. -If the sun is circled, a prominent person would die.
2) Natural events/occurrences associated with specific animals/ animal sounds. -Noise made by an owl. -If 'Andinya' (a bird) perches on a roof of a house. -A jackal. -Crested crane.	-Signals death in a village. -The house will burn. - None given. - None given.	- It signals death in the village. - None given. -If a jackal crosses an individual's path, it signals death or a bad journey. -If a crested crane perches on a tree in a home, an elder in that home will die.
3) Causes of drought.	-A weed in the lake which prevents evaporation. -Too many stars on the sky . -A punishment from God. -It is a season which has to come.	- It is a season which normally comes after the rains.
4) Responsibilities of rainmakers.	-Offer sacrifices and perform rituals so that the rains can come. -Predict the weather . -Measure the amount of rainfall.	- Offer sacrifices and perform rituals so that the rains come (they make rain).
5) Stopping of a hail storm.	-Ashes, a silver coin and glass bottle are thrown out when it starts falling. Place a hoe and a silver coin outside when it starts. -Throw ashes and a silver coin outside as the storm starts. -They can not be stopped.	-Traditional medicine (from a specific plant) thrown outside by a magician when the storm starts. -Throwing a silver coin and or glass bottle outside when the storm starts (this is a recent development).

Phenomena	Pupils' explanations	Explanations by experts on culture
6) Causes of lightning.	<ul style="list-style-type: none"> -Friction between clouds. -Meeting of cold air currents and warm air currents. -Meeting of large hailstorms in the sky -Meeting of winds from low region to upper region. -Red cock. -Red clothes. -Witchdoctors. 	<ul style="list-style-type: none"> -Red clothes. -A red cock. -Witchcraft.
7) Prevention of lightning.	<ul style="list-style-type: none"> -Avoid wearing red clothes. -Trap the red cock. -Can't be prevented- 	<ul style="list-style-type: none"> -Avoid wearing red clothes. -Special charms/traditional medicine used to repulse it. -Have a red cock in a home to repulse it.
8) Getting a child of desired sex.	<ul style="list-style-type: none"> -It is God's work. 	<ul style="list-style-type: none"> - A ritual is performed, the mother is given some traditional medicine before she conceives.
9) Causes of blindness in new born babies.	<ul style="list-style-type: none"> -Mother got infected when pregnant. -Baby got injured before birth. -Mother lacked a balanced diet when pregnant. -Baby was born a premature. -It is God's wish. 	<ul style="list-style-type: none"> -Parents were cursed. -It is God's wish.
10) Causes of madness.	<ul style="list-style-type: none"> -Strong malaria or illness/cerebral malaria. -Injury or damage of the brain. -Witchcraft. 	<ul style="list-style-type: none"> -Inherited in a family. -Too much reading /stress can make the spirit of madness active.
11) Causes of illness and death.	<ul style="list-style-type: none"> -Lack of a balanced diet. -Disease e.g. Malaria. -Dirty food. -A curse. -Witchcraft. 	<ul style="list-style-type: none"> -`Chira' – a curse due to failure to follow prescribed norms in society. -Some illnesses and death are normal.

Table 4. Explanations for selected natural phenomena given by Maasai pupils and experts on culture

Phenomena	Pupils' Explanations	Explanations by Experts on culture
1) Natural events/occurrences associated with the /stars sky.	-Many stars in the sky is a sign of a dry season. -Specific stars indicate the coming of a rain season or a dry season.	- Specific stars indicate the coming of a rain or a dry season.
2) Natural events/occurrences associated with specific animals/animal sounds. Noise made by an owl. A jackal.	-Signals death of a person in a home. -Signals death of livestock or livestock will be stolen. -If it is heard making noise, it signals death of a human being. - none given	-Indicates that somebody will die or our livestock will die. -If it is heard making noise, it signals death of people especially during cattle raids.
3) Causes of drought.	-Strong winds chase rain away. -It is a season that has to come. -Failure to offer sacrifices to ancestors. -It is God's wish.	-It is a season that has to come. -It is a result of a curse. -It is God's wish.
4) Responsibilities of rainmakers.	-Can bring about rain or send it away. -Pray for the rain to come.	- The 'laibon'(Maasai magician) perform rituals and offer sacrifices so that the rains can come.
5) Stopping a hail storm.	- Throw ashes outside using a cooking stick when it starts.	-Ashes thrown outside by a mother whose first born is a girl when it starts falling using a cooking stick. -A stick used to clean the milk gourd is thrown outside together with ashes when it starts.
6) Causes of lightning.	-Sharp objects attract it. -Red objects attract lightning. -A mirror which is not covered attracts lightning. -A gecko (Agama agama). -Meeting of a negative cloud and a positive cloud.	-A curse by `a laibon`. - wearing red clothes.
7) Prevention of lightning.	-A void sharp objects and red clothes when it is raining. -Keep or cover a mirror when it is raining. -Use brown electric wires (arresters).	- There are special people who have the powers to prevent it.
8) Getting a child of a desired sex.	-Traditional medicine administered to the mother before she conceives -It is God's wish	- Traditional Medicine administered to the mother before she conceives.

Phenomena	Pupils' Explanations	Explanations by Experts on culture
9) Causes of blindness in new born babies.	<ul style="list-style-type: none"> -Parents laughed at a blind person. -Social evils committed by parents e.g killing a person. -Mother ate prohibited foods. -It is inherited. -Due to a curse. 	<ul style="list-style-type: none"> -Father may have killed a pregnant dog or cat when wife was pregnant. -Father laughed at a blind person when wife was pregnant. -If mother was infected during pregnancy e.g by an STD.
10) Causes of madness.	<ul style="list-style-type: none"> -Sickness. -Too much use of (illicit) drugs. -Strong malaria. -Too much thinking/stress. -Inherited. -Witchcraft. 	<ul style="list-style-type: none"> -If a man kills or beats up his father and marries before being cleansed. -It is a curse. -Thinking about problems/stress.
11) Causes of illness and death.	<ul style="list-style-type: none"> -Germs/disease causing organisms. -Dirty water and food. -Witchcraft. 	<ul style="list-style-type: none"> -Bad weather. -Disease such as malaria and lack of proper medication. -It is natural. -Witchcraft.

DISCUSSION

It is evident from these results that while some of the cultural explanations/interpretations conform to those given in conventional science, a majority of them are based on superstition and taboos. Those that are in conformity with formal science form a good starting point for the teaching and learning of science.

These results further suggest that the pupils' misconceptions on natural phenomena are largely derived from the explanations or interpretations given in their respective traditional cultures. This is because they are similar or closely related to the interpretations or explanations given by experts on culture from their respective cultural groups as shown in tables 1 - 4. The following excerpts from pupils help to make this point clear.

Note: Names used in all the excerpts are not real.

Exerpt 1: An interview with Linet (pupil) on the causes of Lightning

Interviewer: Linet, do you understand what is meant by lightning?

Linet: Yes, it is a thunderstorm.

Interviewer: What causes it?

Linet: When warm air currents meet with cold air currents.

Interviewer: Where do they meet?

Linet: In the sky.

Interviewer: Then what happens?

Linet: They strike causing lightning.

Interviewer: We are informed that there is a bird called "enkoba" (local name for lightning). Does it play any role?

Linet: No, it is a red cock

Interviewer: What about the red cock?

Linet: It is the one that strikes and burns a tree even a whole house

Interviewer: Where does this red cock come from?

Linet It is formed when the warm and cold air currents meet.

- Interviewer: What can be done to prevent lightning?
- Linet: When it starts raining, we should avoid wearing red clothes, walking through rain water, (surface runoff), making noise, leaning against walls and taking shelter under trees.

Exerpt 2: An interview with Beatrice (pupil) on the determination of a child's sex

- Interviewer: Beatrice, we are told that children are a gift from God. Some couples have both boys and girls while others either have only boys or girls. If a couple wants to have a child of particular sex, let us say a boy, is there anything that they could do to make sure this happens?
- Beatrice: Yes, there is something that can be done.
- Interviewer: What would they do?
- Beatrice: There are medicine women who can administer traditional medicine "irizi" (a tiny stick from a specific tree species specially treated).
- Interviewer: How is this medicine administered?
- Beatrice: The tiny stick is sewn in the hem of the mother's dress.
- Interviewer: Then what happens?
- Beatrice: She will deliver the baby she wanted.
- Interviewer: When is the medicine administered? Before she conceives or after?
- Beatrice: Before she conceives.
- Interviewer: Do you have any of the medicine women you have talked about in your home area?
- Beatrice; Yes, I know one though abit far from my home.
- Interviewer: How did you get to know her?
- Beatrice: She administer the "irizi" on my mother.
- Interviewer: Your mother did not have a son?
- Beatrice: No she didn't. We were four sisters then.

Interviewer: Did it work?

Beatrice: Yes! She gave birth to two boys (twins).

Exerpt 3: An interview with Ochieng (pupil) on the formation of rain

Interviewer: Has your science teacher taught you how rain is formed?

Ochieng: Yes, he said that water evaporates, the clouds form and then, it rains.

Interviewer: We are informed that in your community, there are people known as rain makers.

Ochieng: Yes, we have them.

Interviewer: What is their work?

Ochieng: They offer sacrifices so that it can rain.

Interviewer: Do you know any of these rain makers?

Ochieng: Yes, my grandfather.

Interviewer: Your grandfather is a rainmaker?

Ochieng: Yes, if there is no rain for along time, he takes a sheep, goes to the top of a hill, offers a sacrifice and prays then it rains.

Interviewer: Do you know what he actually does at the top of a hill? Has he taught you how to do it?

Ochieng: No, I have never gone there with him.

Interviewer: Who has? Your brothers?

Ochieng: I am the first born grandson!

Interviewer: What does that mean? Is he going to teach you how to do it?

Ochieng: Yes, he will teach me.

Interviewer: Has he already told you that? Will you also be a rainmaker?

Ochieng: Yes.

Interviewer: Do people pay your grandfather after offering the sacrifice?

- Ochieng: No, it is free.
- Interviewer: Where does he get the sheep to sacrifice?
- Ochieng: We have some sheep.
- Interviewer: People do not pay anything at all?
- Ochieng: Some bring chicken, others may bring sheep.
- Interviewer: Does it actually rain after the sacrifice has been offered?
- Ochieng: Yes it rains.
- Interviewer: After how long? Same day or sometime later?
- Ochieng: It can rain on the same day even before he gets back, or the following day.
- Interviewer: Now, Ochieng, which of the two versions of rain formation you have given us is correct? Is it what you have been taught by your science teachers or what your grand father does?
- Ochieng: I think it is my grandfather's.

It is clear from these excerpts that the pupils' misconceptions are culturally determined and are based on superstition. This finding supports Odhiambo's (1972) view that certain cultural ideas in the African setting may well impinge directly on the ease with which an African child can appreciate science. It also vindicates a view expressed by Strevens (1976) that learners brought up in a culture in which magic and the supernatural play a great role are accustomed to accept relationships or justifications of a non logical kind and belief statements simply because they are made by people in authority. Indeed, as Strevens concludes, such beliefs and schemes of reasoning create barriers to the learning of science. For instance Linet tried to accommodate both cultural and scientific interpretations by trying to explain that the meeting of cold air currents and warm air currents produce "a red cock" which then strikes. As White and Welford (1988) argue, it would appear that when pupils are presented with ideas in science lessons, they try to make them fit into their intuitive ideas and the result may be a mixture of taught science and intuitive science. George (2001) observes that for students in traditional settings, daily living, at least to some extent is guided by a knowledge system that is different from conventional science as thought in schools. This clearly demonstrates a serious conflict. Ochieng has seen people come to request his grandfather (who is a rain maker) to offer a sacrifice and prayers so that it can rain. He knows he is next in line as a rain maker. He, therefore, seems to superstitiously believe that there are people who have the powers to make rain. This seems to be interfering with what he has been taught in science lessons about the formation of rain which he rejects. Beatrice has witnessed her mother's desire to have a baby boy. She detailed what she saw done though she may not have known

all the fine details. At the end of it all, the mother gave birth to twins who were both boys! It, therefore, may be difficult for Beatrice to accept the explanations given on sex determination in biology lessons later. There are a number of such natural phenomena which have cultural interpretations that learners may have been exposed to in their socio-cultural set-ups before they are taught about them in science lessons. The alternative conceptions that arise out of the cultural meanings or interpretations seem to persist and influence their learning of science.

Findings similar to the above have been reported by Ogunniyi (1987) in a study conducted in Nigeria, Krugly – Smolka (1995) in a study conducted in Canada, Shumba (1995) in a study conducted in Zimbabwe, Lynch (1996) in a study conducted in Australia and the Phillipines, and Anamuah –Mensah (1998) in a study conducted on Ghanaian students. This suggests that cultural interpretations of natural phenomena are still valued as explanatory models in traditional societies. It would also suggest that the current approaches to primary science are not able to change the learners alternative conceptions.

SECTION TWO: THE INFLUENCE OF KIKUYU CULTURAL METAPHORS CONCERNING ‘HEAT’ ON SECONDARY SCHOOL STUDENTS’ EXPLANATIONS OF EVERYDAY LIFE EXPERIENCES

The study reported sought to establish whether or not student’s conceptions of heat are influenced by their cultural beliefs. Such information, we believe would be helpful to physics curriculum developers and teachers in planning and developing teaching strategies that can be used to present the concept ‘heat’ to students. Currently there is a widespread acceptance in the international science education research community that students at all levels of schooling have a diversity of ideas prior to formal learning (Driver, 1989; Zietman and Naidoo, 1977). The concept ‘heat forms an important part of every science curriculum from primary school up to University level. It is therefore important to understand the ideas about the concept of heat that pupils carry from their cultural beliefs to science lessons. Hewson and Hamlyn (1984) reported misconceptions about heat among the Setho people of Southern Africa. Schapera (1979) pointed out that there is a prevalent metaphor involving heat amongst many African people. Lakoff and Johnson (1981) pointed out that the metaphor is grounded in experience and is a dominant aspect of the social and physical environment of the people.

PURPOSE OF THE STUDY

The study aimed at finding out whether or not metaphors concerning heat exist in students’ explanations- of real life experiences among the Kikuyu cultural group living in Nyandarua District-Kenya.

Methodology

A cross sectional survey research design was used in this study. 269 Form One (first grade in secondary school cycle) students were randomly selected from 7 schools and 225

Form Three (third grade in secondary school cycle) students were also selected randomly from 10 schools. The average age of students in forms one and three is 14 and 16 years respectively. A total sample of 494 students participated in the study. A questionnaire was used to establish whether or not students use metaphorical heat conceptions in explaining life situations. The questionnaire had a total of 8 items. Each item described a real life situation involving people or animals and students were asked to explain whether or not such people or animals could be described as hot. The items used reflected life situations that have some cultural significance among the Kikuyu tribe of Nyandarua District, Kenya. The real life situations discussed included anger, initiation, cow on heat, bees attack and menstruation. More information can be found in Kaboro (2003). Oral interviews were conducted on 24 students in order to probe deeper into some of the responses given in the questionnaire. The students interviewed included 14 randomly selected from those classified as subscribing to the types of responses categorized as behavioural changes and 10 from those subscribing to the category of responses referred to as biological changes. A student was classified as belonging to either of these categories of responses if in 6 or more of the 8 items in the questionnaire, he/she used ideas in that category to explain the responses. The students interviewed from each category were 5% of the total number of students in that category. The interview schedules used were unstructured.

RESULTS

Students' Metaphorical Heat Conceptions

The study aimed at establishing whether cultural beliefs in form of metaphors concerning heat exist in students' explanation of everyday life experiences. A questionnaire and unstructured interview were used to collect data from Form One and Form Three students in secondary schools in Nyandarua District, Kenya. Data collected from each item were presented as follows:

- (a) the frequency and percentage of students subscribing to the categories of behavioural and biological changes.
- (b) Sample responses for each of the categories are quoted verbatim with only minor modifications to make reading possible.
- (c) Sample interviews that took place between the researcher and the respondents.

The real life situations are reported in the following order. Anger, Cow on heat, Initiation, Bees attack and Menstruation.

ANGER

The following is a situation in which Mr. Njoroge was described and pupils asked to say whether or not he could be described as hot.

“Mr. Njoroge is very annoyed by his neighbour. He is shouting and gesturing at him angrily. Would you describe him to be ‘hot’?”

Yes No (tick appropriately)

Explain your response.....

The distribution of the types of responses given by the students is given in table 5

Table 5. Distribution of students’ responses concerning the use of the term ‘hot’ to describe an angry person. (N=494)

Category of response	Frequency	Percentage
Behavioural changes	268	54.2
Biological Changes	119	24.1
Negative	86	17.4
Non-respondents	21	4.3

It can be noted from table 5 that a high percentage (78.3%) agreed with the suggestion that an angry person can be described as hot. Out of these 268 (54.2% subscribed to behavioural changes and 119 (24.1%) to biological changes. Only 86(17.4%) did not agree with the suggestion. Sample responses are given below:

Sample Response (Behavioural)

Form I/Male student

Yes I would say Njoroge is ‘hot’ because at the moment he is shouting and quarrelling his neighbour, he is in a hot temper. He can even end up fighting.

The student was further probed through an interview, which went on as follows:

Researcher: How did you know this? Is it something said in your culture?

Student: In Kikuyu, a person who gets angry easily is described as ‘ni muhiu mutwe’ (he has a hot head).

Researcher: So Njoroge is one such person?

Student: Yes

This cultural meaning would affect the teaching of the concept ‘heat’ because the students would find it difficult to relate it to the scientific meaning because the cultural meaning does not involve temperature changes or energy of molecules in a body. So it is the responsibility of the teacher to convince learners that the cultural meaning of heat is different from the scientific meaning.

Sample Response 2 (Biological Changes)

From 3/Female student

Njoroge can be said to be 'hot' because when somebody gets annoyed or angry you see him sweating as he talks so he is 'hot'

Interview Went on as Follows:

Researcher: You say Njoroge can be described as 'hot' because the temperature of his blood has risen due to hunger in him. Do you mean to say his blood is hot?

Student: Um... . Not exactly, what I want to mean is that because of the anger in him he... appears to be hot – not the normal heat that can burn but.....

Researcher: Some other kind of hotness?

Student: Yes... Um.... You see because of the anger in him, he is not at peace within himself. His heart is pumping faster .. he is hot.

This student holds both the Kinetic Theory and the cultural meaning of hot. For example, he associates sweating with temperature rise but he again says that is not the heat that can burn.

Cow on Heat

A cow on heat is usually very restless. Would you describe such a cow as 'hot'?

a) Yes No (tick appropriately)

b) Explain your response.....

The distribution of the students' type of responses is given in table 6

Table 6. Distribution of students' responses on the use of the term 'hot' to describe a cow on heat (N=494)

Category of response	Frequency	Percentage
Behavioural changes	245	49.6
Biological Changes	116	23.5
Negative	101	20.4
Non-respondents	32	6.5

It can be noted from table 6 that 361 (73.1%) agreed while 101 (20.4%) of the respondents disagreed with the statement. Those who agreed 245 (49.6) subscribed to behavioural changes while 116 (23.5%) subscribed to biological changes.

Sample Response (Behavioural)

Form 1/Female student

Student: Yes, it can be described as ‘hot’ because when cows are on heat, they become restless and keep moving and mounting others. They do not settle.

Interview with the Student

Researcher: You say the cow can be described as ‘hot’ because it keeps on moving and mounting others. Is that true?

Student: Yes, um... the cow is not settled at one place, it moves about... abnormally.

Researcher: This renders it the description of ‘hot’?

Student: ah... yes, I would say so.

Researcher: Is this expressed in your culture?

Student: Er... yes, such a cow is said to “have a heat” (I na u rugari),... not a heat that can burn, but it makes the cow behave abnormally. This Student has both the pre-Kinetic Theory and the cultural meaning of heat.

Sample Response (Biological)

Form 1/Female Student

Student: Yes, the cow can be described as ‘hot’ because it is being disturbed by its body. Its temperature is high, so it can be said to be hot.

Interview

Researcher: You said that cow’s temperature is high. Is that so?

Student: Yes, the cow is burning with desire, this makes its temperature high’.

Researcher: A cow is a mammal... so if it’s temperature were to be higher than normal it would be sick.

Student: Um... Yeah, but in this case it is not that the cow will be hot ... what I mean is that it is being disturbed by the state it is in... so it keeps moving and become restless.

This student associates heat with temperature change, the Kinetic Theory. But he admits that there is no actual temperature change in the cow's body. A manifestation of a misconception about 'heat'

Initiation

A group of boys are about to face a circumciser during an initiation ceremony. would you describe the boys as 'hot'

- a) Yes No. (tick appropriately)
- b) Explain your response.....

The distribution of the types of student's responses is given in table 7.

Table 7. Distribution of student's responses on the use of the term 'hot' to describe boys involved in an initiation ceremony. (N=494)

Category of response	Frequency	Percentage
Behavioural changes	228	46.2
Biological Changes	137	27.7
Negative	87	17.6
Non-respondents	42	8.5

It is noted from table 7 that 563 (73%) of the students agreed with the Statement while on 87 (17.62%) of the students disagreed.

Sample Response (Behavioural Change)

Form 1/Male Student

Student: Yes, they can be said to be 'hot' because of the fear in them. They are very afraid of the circumciser and are worried of the pain they are going to experience.

Interview

Researcher: You say the boys can be described as 'hot' because they are very Anxious and nervous, true?

Student: Yes, they have never gone through it (circumcision) before and they know it is a painful process.

- Researcher: So because of anxiety, you can describe them as hot.
- Student Er... Yeah, but not that they are 'hot' as of high temperature but ... I mean.....

This student has the scientific meaning of heat (Kinetic Theory implied) and the cultural meaning associated with anxiety.

Sample Response (Biological Change)

Form 3/Female Student

- Student: Yes, the boys can be described as 'hot' this is because they sweat Even when it is cold because of fear.
- Researcher: You say the boys are 'hot' because you can see them sweating even when it is cold?
- Student: Yes.. they are afraid... they tremble with fear.
- Researcher: Fear makes them hot?
- Student: Not that their bodies are hot as such... what I mean is that they do not have peace within themselves... their hearts' are pumping faster... so blood is flowing faster.
- Researcher: Is this why they sweat?
- Student: Er... yeah they sweat not because of heat, but ... because of fear in them.

Bees Attack

A swarm of bees invade a classroom full of students studying. The Students run out helter skelter. Would you describe this situation as 'hot'.

- a) Yes No (tick appropriately)
- b) Explain why you say so.

The distribution of students responses are given in table 8.

Table 8. Distribution of students responses on the use of the term 'hot' to describe students' under bees attach (N=494)

Category of response	Frequency	Percentage
Behavioural changes	256	51.8
Biological changes	147	29.8
Negative	70	14.2
Non-respondents	21	4.2

Results given in table 8 show that 403 (81.6%) of the students agreed with the statement and only 70 (14.2%) disagreed with the statement. Out of the 403 students who agreed with the statement 256 subscribed to the behavioural changes while 147 subscribed to biological changes.

Sample Response (Behavioural)

Form 1/Male student

Student: Yes, the students can be described as hot. I say so because this is a bad situation as the students face the danger of being stung by the bees.

Interview

Researcher: You describe the students as hot because they are in a dangerous situation, is that true?

Student: yes, that is true.

Researcher: So according to you people in dangerous situations can be termed 'hot'?

Student: Yes the situations is 'hot' itself.

Researcher: In kikuyu, do you have anything in your language or beliefs that imply this:

Student: Yes, we say a very bad situation is a 'hot' one ... "ni kuhiu muno." So people in such a situation can also be said to be 'hot'.

This student associates 'hotness' with a dangerous situation.

Sample Response (Biological)

Form 3/Male Student

Student: Yes, the students can be described as 'hot' because as the bees sting them, their bodies become hot because of pain.

Interview

- Researcher: You say the bee stings making the blood of the student hot?
- Student: Yes,... The stings are very painful.
- Researcher: How does the pain make the blood hot?
- Student: Er... I don't mean to say the blood becomes hot... What I mean is that the stings are very painful and so the student who is stung is very uncomfortable.
- Researcher: Then in that state you describe him as 'hot'
- Student: Um... yeah, we can say that.

Menstruation

Girls at puberty normally have menstruation would you describe a menstruating girl as 'hot'

- a) Yes No (tick appropriately)
- b) Explain your response.....

The Distribution of students' response is given in table 9.

Table 9. Distribution of students response on the use of the term 'hot' to describe menstruating girls (N=494)

Category of response	Frequency	Percentage
Behavioural changes	199	40.3
Biological changes	179	36.2
Negative	85	17.2
Non-respondents	31	6.3

Results in table 9 show that 378 (76.5%) of the students agreed with the statement while only 85 (17.2%) disagreed. Out of those who agreed 199 (40.3%) subscribed to behavioral changes and 179 (36.2%) to biological changes.

Sample Response (Behavioural)**Form 1/Female student**

- Student: A menstruating girl is in a very uncomfortable situation those things (blood) may come out unexpectedly and they feel shameful. Such girls can be described as hot because they are 'moody'.

Interview

- Researcher: You have explained that the girls are 'moody' at such time, so they can be said to be 'hot', true?
- Student: Yes, ... they are always angry.
- Researcher: The anger makes them 'hot' or what?
- Student: Er ... not really, ... not that they are 'hot' as to have high temperature but they are ... not comfortable.

This student associated the state of the body of a menstruating girl with 'heat'. But she also knows the scientific meaning of heat due to temperature change.

Sample Response (Biological)**Form 3/Female Student**

- Student: Yes, the girl can be described as 'hot'. This is because the process is accomplished by a lot of blood loss and is sometimes painful.

Interview

- Researcher: You say there is a lot of blood loss and pain and because of these the girl can be described as 'hot' is that right?
- Student: Yes, there is a lot of blood movement in the body, because the heart is pumping faster.
- Researcher: So the girl is 'hot'?
- Student: Yeah, we can say she is 'hot'
- Researcher: Meaning her body temperature is higher than normal?
- Student: No... this is not an illness, it is a normal process, only that it is sometimes painful.
- Researcher: So when you say she is 'hot' it does not mean her body temperature is higher.
- Student: No, its only that she might be in pain.

Discussion

Analysis of students' responses show that the majority of students hold Kikuyu cultural meaning of 'hot'. The category of responses also shows that the majority of the students

described 'hot' in terms of behavioural changes. These ranges from annoyance, anticipated pain, actual pain experienced to body in comfort. Those who associated 'hot' with biological changes talked of or implied temperature rise. Such students hold both cultural meanings and scientific meaning of heat. This conflict between cultural and scientific meanings of heat will definitely affect the teaching of the topic heat.

The results obtained in this study, can be viewed in the context of the students' cultural beliefs concerning heat. The social and economic life of Kikuyu people appears to have given rise of metaphor concerning heat. The people in this region are predominantly small scale farmers. For this reason climatic conditions are of special concern to them and heat pervades many aspects of their lives. Among the Kikuyu people there is belief that 'coolness is good' and 'hotness is bad'

SECTION THREE: THE INFLUENCE OF AFRICAN CULTURE ON STUDENTS' CONCEPTIONS OF THE TOPIC NUTRITION IN SECONDARY SCHOOL BIOLOGY: A CASE STUDY OF THE BUKUSU CULTURAL GROUP OF BUNGOMA DISTRICT-KENYA

Purpose of Study

The purpose of the study was to investigate the influence of Bukusu culture on students' conception of the topic "Nutrition in secondary school biology.

Methodology

A simultaneous cross-section survey research design was used in the study. A sample of 217 students participated in the study. The students were randomly selected from 5 secondary schools. The sample comprised 117 Form One and 100 Form Three students. 113 students were male and 104 were female. A questionnaire having open ended items based on concepts in the topic nutrition was administered on the students. The students were given 1 hour to answer all the questions in the questionnaire. Oral interviews were conducted with 4 Form 1 students and 4 Form 3 students. Simple random sampling technique was used in selecting the 8 students for interview. 5 out of these were males and 3 were females. Data collected were analyzed qualitatively.

Results

The items in the questionnaire were grouped into two categories namely:

- (i) Biological phenomena/concepts associated with animals.
- (ii) Biological phenomena/concepts associated with food.

The students' responses to items in the questionnaire were categorized as being either scientific or cultural. The responses were also categorized on the basis of the cognitive level of the learners (Form one or three) and their gender and are presented in table 10. The responses were generated from the following two questions.

Question 1

Wasonga woke up one morning and discovered that he had swollen eyelid. What could have been the cause of swelling?

Question 2

Why do some people in the Bukusu community not like eating pork.

Table 10. Students' scientific and Bukusu cultural explanations for biological phenomena associated with animals, according to cognitive level of gender (N=217)

	FORM 1						FORM 3					
	Male		Female		Total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1. Cause of swollen eyelid												
Scientific Explanations												
Lack of vitamins	8	7.1	4	3.3	12	10.9	18	15.9	6	5.3	24	21.2
Bacterial infection	3	2.7	4	3.8	7	6.5	10	8.8	3	2.9	13	11.7
Bukusu Cultural Explanations												
Denying a dog food	40	35.8	44	42.3	84	78.1	28	24.8	27	23.9	55	48.7
Form of a curse	9	8.8	5	4.8	14	13.6	2	1.8	6	5.3	8	7.1
2. Reasons for not eating pork												
Scientific Explanation												
Cause of tapeworms	40	35.4	34	32.7	74	68.1	46	40.7	43	41.3	89	8.2
Bukusu Cultural Explanation												
Pigs have evil spirits	16	14.2	18	17.3	34	31.5	5	4.4	6	5.7	11	10.1
No response	6	5.3	3	2.9	9	8.2	-	-	-	-	-	-

Causes of Swollen Eyelid

It is noted in table 10 that the students that gave scientific meanings were only 56 (25.8%) as compared to 161 (74.2%) who gave Bukusu Cultural explanations. Those who gave scientific explanations were 11 Form 1 boys and 28 Form 3 boys showing a difference in cognitive levels. 8 Form 1 girls and 9 Form 3 girls gave scientific explanations. There seems to be no difference according to cognitive level for the girls. What is significant is the

great difference in the number of students using scientific explanations and those using the Bukusu cultural interpretations. The Bukusu cultural explanations of the cause of swollen eyelid do not indicate any gender difference since the number of boys and girls giving the same explanations were about equal.

Reasons for not Eating Pork

Students who gave scientific explanations were 163 (75.1%) compared to 45 (20.7%) who gave cultural explanations. For those who gave scientific explanations there were no difference in terms of cognitive level as well as gender. This is perhaps because this topic is covered in form one, thus the two groups (Form one and Form three) have the same knowledge. 34 out of the 45 students who gave cultural explanations were form one students and only 11 were Form three students. This shows that the Bukusu explanations reduce when students advance academically.

Students' scientific and Bukusu cultural explanations of biological phenomena associated with foods, according to cognitive level and gender are given in table 11. Students' responses were elicited using the following questions.

Question 3

Wanyonyi was advised by his parents not to eat bananas at night. What is the explanation for this?

Question 4

In the Bukusu community, children are advised to eat the head of a fish. What is the explanation for this?

Question 5

Nekesa gave birth to a baby who took a considerably long period of time before it learnt to talk. What could have been the problem?

Question 6

It is recommended that both meat and milk should not be used in a meal at the same time. What is the reason for this?

Question 7

What is the effect of eating too much sugary food on your body?

Question 8

Barasa and Wanjala were born identical twins, but after some time Wanjala grew bigger than Barasa. What reason is given for the difference in the growth rate?

More information can be found in Kandawala (2004)

Table 11. Students' scientific and Bukusu cultural explanations of biological phenomena, associated with foods according to cognitive level and gender (217)

	FORM 1						FORM 3					
	BOYS		GIRLS		TOTALS		BOYS		GIRLS		TOTALS	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
3. Reason for not eating bananas at night												
Scientific Explanations												
a) causes of constipation	21	9.7	13	5.9	34	15.7	33	15	24	11	57	26.3
Bukusu Cultural Explanations												
a) It is a light food	33	15.2	40	18.8	73	33.6	15	6.9	13	6.0	28	12.9
b) Attracts wizards	5	2.3	5	2.3	10	4.3	5	2.3	2	0.9	7	3.2
c) Non-response	5	2.3	7	3.2	12	5.5	6	2.8	3	1.4	9	4.2
4. Reasons for eating fish head												
Scientific Explanations												
a) Rich in minerals	2	0.9	4	1.8	6	2.8	13	6.0	8	3.7	21	9.7
5. Reasons for not eating both meat and milk same time	58	26.7	53	24.4	111	51.1	37	17.1	42	19.4	79	36.4
Scientific Explanations												
a) Both are proteins	19	8.8	16	7.4	35	16.1	22	10.1	25	11.5	47	21.7
Bukusu Cultural Explanations												
a) Causes death of calf	39	18.0	30	13.8	69	31.8	26	12.0	19	8.8	45	20.7
b) Non satisfaction	2	0.9	4	1.8	6	2.8	3	1.4	0	0	3	1.4
c) Bad omen	5	2.3	2	0.9	7	3.2	3	1.4	2	0.9	5	2.3

It is noted from table 11 that the number of students' who gave scientific explanations concerning foods were in Form 3 and more boys than girls gave such explanations. In contrast a majority of those who gave Bukusu cultural explanations were Form one students. This suggests that the use of cultural explanations reduces with more exposure to science education.

CONCLUSION

The empirical studies presented in this chapter are a clear manifestation of cultural influence on the learning of formal science in the African context. This poses challenges to the teaching and learning of Science in Africa.

For effective teaching and learning, the conceptual base of African traditional/cultural practices (beliefs and belief systems) need to be made explicit and brought to the fore. This is a mammoth task which never the less needs to be undertaken. Science teacher education should place emphasis on the use of more interactive approaches that require active learner participation in science lessons. This would allow learners to actively construct knowledge for themselves and, therefore, engage in meaningful learning. This would enable them to cross the conceptual boundary between their cultural context and that of formal science. Curriculum developers should also consider the learners' cultural milieu. This would enable them to devise appropriate learning experiences that would allow learners to cross the conceptual bridge. Indeed, as Willg (1990) asserts, for effective teaching and learning of science, the starting point is the learners' existing knowledge.

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Chapter 5

NON-LINEAR DYNAMIC MODELING OF MICRODEVELOPMENTAL PROCESSES OF STUDENTS' CONCEPTUAL CHANGE IN SCIENCE

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ABSTRACT

This chapter reports a study using non-linear dynamic and microdevelopmental approaches to modeling students' conceptual change in science. Cognitive processes of children's conceptual change in learning a scientific concept, i.e. magnetism, were intensively observed at an interval of minutes, and a mathematical model was then applied to fit the observed patterns. Based on the comparison between the three simulated trajectories and the three empirical trajectories, we identified a dynamic reciprocal interaction between the student's actual developmental level and the instructor-guided potential developmental level responsible for different microdevelopmental trajectories. It was also found that the dynamic interaction between the rate of cognitive growth and the difficulty of learning content explained the variability of individual students' learning trajectories. The research findings suggest that cognitive processes of conceptual change in science are a self-organizing system in which various trajectories of learning emerge through the interactions between student parameters (e.g., prior knowledge and rate of learning) and teacher parameters (e.g., instructional goals and pace of teaching).

INTRODUCTION

Conceptual change research has been one of driving forces for science education reform in the last two to three decades (Duit & Treagust, 2003). Conceptual change research is rooted in two schools of scientific enquiry: science education and cognitive and

developmental psychology (Sinatra & Pintrich, 2003; Vosniadou, 1999). The interest and emphasis in conceptual change are different from each other between the researchers in these two schools due to their different beliefs of the nature of conceptual change, theoretical foundation, and the approaches to fostering conceptual change. Cognitive developmental researchers tend to focus on the role of internal workings of individual cognitive structures in conceptual change processes by coupling conceptual change with individual cognitive development from the Piagetian's perspective. Conceptual change is conceived of as a domain-general reconstruction of individual cognitive systems that affect knowledge acquisition processes (Vosniadou, 1999). The science education perspective stemmed from teachers' and researchers' observations that students come to science classrooms with a diverse set of alternative conceptions concerning natural phenomena regardless of their age, ability, gender, and cultural background (Wandersee, Mintzes, & Novak, 1994). Accordingly, a teacher's major task in science teaching is to facilitate students to change their preconceptions or naïve knowledge to the scientifically correct conceptions. Due to the inherent connection to practices of science education, therefore, the interest for researchers in science education is primarily in investigating theories, learning environment, and instructional strategies that would effectively bring about conceptual change in science classrooms (She, 2004). For example, the conceptual change researchers in science education tend to answer such questions as whether cognitive conflict is a good strategy for generating conceptual change, how robust, coherent and resistant to instruction students' pre-instructional conception are, and so on (Vosniadou, 1999). The effectiveness of instructional strategies is typically assessed by a pre- and post-test design, which is conducted before and after pedagogical intervention respectively. This kind of design can yield a change profile from students' pre-instructional conceptions to the corresponding scientific conception that is thought to be the result of the given instruction strategy.

Data collected before- and after- conceptual change instruction, however, do not allow precise conclusions to be made about the process of conceptual change because of the low density of observation (pre-test and post-test). We don't know what actually happens in the course of change that is crucial for scientifically understanding how conceptual change occurs under various learning and teaching conditions. Conceptual change can be identified as individual students' trajectory of understanding of a given topic or discipline (Linn, in press). Linn's view of conceptual change suggests a need to shift the state-oriented methodologies that have been adopted in many current conceptual change studies to process-oriented methodologies in order for researchers to reveal the nature and mechanism as well as the factors underlying conceptual change. Process-oriented approaches are also applied in dynamic assessment of students' learning, and achievement (Jeltova, Birney, Fredine, Jarvin, Sternberg, & Grigorenko, 2007).

Recent studies emphasize the role of learners' intention in conceptual change including such theoretical constructs as motivation, interest, goals, and epistemological beliefs (Sinatra & Pintrich, 2003). Regardless of the theoretical stances, cognitive view or sociocultural view of conceptual change (Mason, 2007), current studies of conceptual change converge at the following basic issues that include what changes, who changes, how change occurs, where change occurs, and so on (Mayer, 2002). Answering those basic questions requires effective approaches to uncovering the process of conceptual change when students engage in it. In this sense, acquiring comprehensive knowledge about the nature and mechanism of conceptual change, as well as the internal and external factors fostering or hindering this change, requires

accurate real-time fine-grained data to be directly collected during the process of conceptual change.

Qualitative interpretative methods are typically used to describe the process of students' conceptual change (Venville & Treagust, 1999; Chiu, Chou, & Liu, 2003), but quantification of conceptual change processes, such as mathematically modeling the processes, has not been reported in the literature. The present study adopts non-linear dynamic and microdevelopmental approaches to mathematically describing students' conceptual change, and to demonstrating how they can reveal patterns and mechanism of conceptual change in science learning. Next, we will give an overview of the two approaches: microdevelopmental or microgenetic methodology, and non-linear dynamical system theory.

MICRODEVELOPMENTAL METHODOLOGY

Microdevelopmental or microgenetic methods were first used among developmental psychologists in their attempts to overcome limitations of the conventional cross-sectional study and longitudinal designs for understanding development, change, and learning (Kuhn, 1995; Granott & Parziale, 2002; Flynn, Pine & Lewis, 2007). The former aims at comparing the performance of different subjects, the latter is for comparing the performance of the same subject at different developmental stages. Both types of studies can reveal a general outline of changes, and yield valuable information regarding stability of individual differences over time. In both cases, however, the studies seldom tell us exactly how change actually occurs, because they yield too low a density of observations to allow precise depiction of the ongoing process of change. The low density of observations, which is one of characteristics of the two types of conventional methods, reduces the potential of these studies to advance understanding of changes in students' thinking, limiting what we can learn about particular changes and not allowing rigorous tests of general hypotheses about how the change occurs.

The microdevelopmental approach has three features: (a) an observation period spanning the whole period of change; (b) a high density of observation while the change is occurring; (c) intensive, trial-and-error assessments of ongoing changes (Kuhn, 1995; Granott & Parziale, 2002). The microdevelopmental approach could enable researchers to look into the ongoing process of the five dimensions of the change deeply and extensively – the path, rate, breadth, variability, and sources of change. Because the microdevelopmental approach focuses on change over minutes, hours, or days, it provides a microscopic perspective on students' conceptual change in science classrooms that is crucial to reveal the internal and external factors that exercise their influential functions. According to Flynn and Siegler (2007), first, examination of the path of change enables researchers to recognize whether individuals have undergone a qualitative change (e.g., radical conceptual change), or quantitative change (e.g., weak conceptual change), or both. Second, examining the path of change makes it possible to find whether children show regressions in performance once new, more sophisticated levels of ability appear. Third, the path of change provides information about the types of knowledge states that individuals progress through before they have full competence or a scientific conception has been established.

The second basic issue regarding change, according to Flynn and Siegler (2007), is the rate at which change occurs, namely the speed of change. Microdevelopmental studies are

particularly well suited to examining this dimension of change, for they involve repeated presentation of the task to the same child and the sessions are close enough in time to provide fine-grained information on the rate of change. For instance, through microdevelopmental studies, researchers could solve such a dispute regarding whether cognitive changes occur gradually or abruptly. However, longitudinal studies have provided a useful overview of the stability of individual differences over time, but have been less helpful for understanding individual variation in the change process itself (Sielger & Crowley, 1991).

The breadth of change is related to the question that once children construct a new way of thinking, how widely do they generalize it? For example, when children acquire a new strategy, do they immediately apply it to all applicable problems? Microdevelopmental methods are thought to be able to provide us with crucial evidence to answer the above questions, because of their dense sampling of the performance of individuals, both when they construct the new strategy and after.

Issues regarding individual variation in change patterns have been ignored by most studies of the development of understanding of specific concepts and of problem-solving skills (Siegler & Crowley, 1991). Microdevelopmental methods yield rich data regarding the path, rate, and breadth of change, which allows for a more precise depiction of individual differences along all three dimensions.

DYNAMIC SYSTEM THEORY

Several studies about the process of conceptual change have indicated that students often vacillate between alternative and scientific conceptions before they arrive at a stable status of understanding of a concept (Shymansky, Yore, Treagust, Thiele, Harrison, Waldrip, & Stocklmayer, 1997). This finding in principle suggests that the process of conceptual change is non-linear, complex, and dynamic. Fine-grain and quantitative modeling features of this dynamic system. According to van Geert (1998, 2000), a dynamic system is any formal specification of a relationship between a set of properties at one point in time and a set of properties at previous point in time, and aims at explaining the change by providing a mathematical representation of the process (van Geert, 1998, 2000; van Geert & Steenbeek, 2005). Yan (2000) further pointed out four aspects of a dynamic cognitive system to be: (a) multiple factors of differing importance contributing to cognitive growth; (b) these factors constantly interacting with each other in complex ways, directly and indirectly; (c) the interactions taking place in multiple contexts; and (d) interactions in a context bringing about short-term and long-term change. In recent years, an increasing number of developmental psychologists have introduced non-linear dynamical systems into the study of cognitive development (Fischer & Bidell, 1998; Thelen & Smith, 1997; van Geert, 1994, 1998; Yan, 2000; Yan & Fischer, 2002; van Geert & Steenbeek, 2005). These dynamic models are primarily intended to mathematically describe the change of behavioural and cognitive development, namely, a transformation of one “state” into another such state (van Geert & Steenbeek, 2005). This approach to studying change has not been reported in science education literature, particularly in studying students’ conceptual change. The notion of emergence is fundamental to the idea of dynamic systems—the temporary but coherent coming into existence of new forms through ongoing intrinsic processes (Smith, 2005). Smith

also claimed that cognition can be conceived as dynamic system. In other words, cognition is just an in-the-moment event in time in the context; the emergent product of many lower-level elements in the system bound to each other and to the world in real time (Smith, 2005). This emergentist feature of a dynamic system implies that cognitive processes such as conceptual change can be conceptualized as self-organizing system. In the field of psychology, self-organization means the spontaneous emergence of complex, orderly patterns of cognition out of recurring interaction among lower-order elements (Lewis, 1995). No single force leads to this emergence. Emergent phenomena in self-organizations depend on the mutual interplaying of a set of contributing influences (Carver & Scheier, 2002). It involves the generation of unpredictable forms from interaction of lower-order components.

A self-organization has four key aspects (Lewis, 1995):

Recursion – Self-organization systems are recursive. They continuously revise their own products. In a psychological system, recursion can be observed in the flow of cognition revising itself over time. That means that product of any cognitive activity is always treated as condition for subsequent cognitive activity. Recursion not only helps stabilize existing system, but also generates new forms of the system as well.

Emergence – Critical feature of self-organization. Pattern emergence occurring at global level is the result of the interactions of the local-level elementary components of a system.

Consolidation – Although unpredictability is a key characteristics of self-organization, the interaction of elements of the system eventually leads to coherence or a stable state. In self-organization, stability emerges over time from a temporary chaotic process. In dynamic systems terminology, such a stable state is referred to as attractor, which is the final state that a system changes toward.

Change – The state space of a self-organizing system shifts over time, called a phase shift. It implies that the emergence of new attractors representing a new landscape of alternative stable states. Phase shifts are discontinuous (i.e., non-linear) rather than gradual.

According to dynamic system theory, the behavior of the system is not influenced in a simply linear way by the factors operating on it, but in nonlinear and interdependent way. That is to say that determinism in principle, but unpredictability in practice, underlies a dynamic system (Carver & Scheier, 1998). Determinism, as a philosophical doctrine, asserts that “every event, act, and decision, is the inevitable consequence of antecedents that are independent of the human will” (van Geert, 1997, p. 13). An important theme in dynamic system thinking is that many relationships between variables are non-linear. Many people are accustomed to thinking of important relationships as linear. That’s the principle on which most statistical procedures are based. For instance, when we look for a correlation between two variables, we are actually looking at a linear relationship. Conversely, nonlinearity occurs when the effect of some variable differs across different parts over its range. Traditional ways of thinking in psychology have no place for nonlinear thinking and the dynamic system approach is a new way of thinking for psychology (van Geert, 1997).

Vygotsky’s best known contribution to developmental psychology is his answer to the question on how development comes about as a consequence of instruction, play, help, and learning. According to Vygotsky (1935/1978), children have at least two development levels. One is the actual level that can be measured by observing a child’s independent problem solving. Another is the potential level that can be achieved with the help of competent others. The distance between the actual and potential levels is the Zone of Proximal Development (ZPD). The ZPD can be closed through internalization. When the child performs an activity

or solves a problem with the help of more competent others, that activity or problem solving remains an external operation. Later, the external operation is reconstructed and begins to occur internally (Vygotsky, 1935/1978). The interpersonal processes involved in guidance by a more competent person are then transformed into intrapersonal ones within the child. Thus, learning is viewed as a process of performing activities with the help of others, transforming the potential developmental level into the actual level. Vygotsky tried to account for the dynamics of development by describing a mechanism of interaction between actual and potential developmental levels. The ZPD model implies that there can be different patterns of change depending on conditions under which a change is occurring. From the perspective of a dynamic system, the potential developmental level is the attractor – a stable phase space in the course of change starting from the actual developmental level.

However, the ZPD model is stated in a qualitative term, which is imprecise. In order to study the hidden aspects of the change mechanism, van Geert (1994) employed concepts and methods from non-linear dynamic theories to transform the Vygotskian model of change mechanism into a deductive, mathematical model of change. Van Geert's dynamic ZPD model consists of a set of difference equations. The detailed description of the parameters in the difference equations will be given in the section of data analysis below. Each equation describes a principle or mechanism of change and how this change is affected by the variables involved. The equations produce patterns of both qualitative and quantitative growth. The difference equations also represent the relationship between two variables, children's actual level and potential levels, as the actual level changes into the potential level after some time. In addition to the variables of actual and potential development, a dynamic model must distinguish an entrance level and an equilibrium state. The entrance level is the conception the child brings when entering into the learning process. The equilibrium state is the conception that results from the learning and instruction process – the learning objectives which are the attractors in the dynamic system.

In the present study, a microdevelopmental approach was used to describe four Grade 5 students' conceptual change trajectories. The dynamic growth modelling was then applied to model those trajectories in order to identify mechanism of students' conceptual change in learning magnetism. The purpose of this study is to reveal mechanism of dynamic variations of conceptual change by addressing the following research questions:

1. What are the trajectories of the microdevelopment of conceptual change in learning magnetism for Grade 5 students? This question involves the following sub-questions: What is the general pattern of microdevelopmental trajectories across individual students? Are there any important differences in the trajectories among students? And how do these trajectories change over time?
2. What is the mechanism that underlies the various individual microdevelopmental trajectories?

METHODS

Participants

In order to best scaffold students for conceptual change, individualized one-on-one instruction was used in this study. Four students (one boy, three girls) from a Grade 5 class at a Canadian elementary school volunteered to participate in the study. Research has shown that students at elementary grades demonstrate a variety of conceptions about magnetism. For instance, many students believe that bigger magnets are stronger than smaller ones, and some even associate magnetism with air (Barrow, 1987; Finley, 1986). Thus, students' conceptual change on magnetism at Grade 5 afforded various conceptual change patterns for research.

Conceptual Change Instruction

The students had just finished a unit on magnetism, thus had some knowledge about magnetism. They learned that metals were attracted to magnets; there were two poles on a magnet and like poles repel and unlike poles attract. However, they remained unsure about the nature of magnetism—a force in a field. Nor were they clear about how a compass worked and what was the relationship between electricity and magnetism. Given the above, we decided to focus our individualized instruction on further developing students' understanding on the nature of magnetism.

The individualized instruction included four lessons. Each lesson was structured around a series of hand-on activities. The activities were designed to facilitate students in constructing their own knowledge about the concept of magnetism, and to increase their levels of understanding through the interactions with the first author (acting as the teacher).

The teaching sequence in all the lessons followed the 'Prediction-Observation-Explanation' format. In the beginning, students were asked to offer their own predictions on a specific magnetic phenomenon, for instance, 'What is your prediction on the interaction between two poles?' They were then asked to explain their predictions. After that they conducted or observed an experiment related to a magnetic phenomenon, for instance, like poles repel each other. Finally, they were asked to make their own conclusions from what they did or observed. As one-on-one teaching was used in this study, it was possible for the instructor to make adjustments to the plan in order to adapt to students' actual levels during instruction.

Four students participated in the four learning sessions. Students and the first author sat face to face at a table. Each session lasted 30-50 minutes. All the activities took place in a resource room of the school. All the sessions were videotaped and then transcribed.

Coding Scheme

The concept of magnetism was divided into the following 13 elements:

1. There are a variety of magnets in terms of size, shape.
2. Magnets attract objects.

3. Not all the metals can be attracted by magnets; magnets only attract objects that are made of or contains iron and steel.
4. Every magnet has two poles: North pole and south pole.
5. Unlike poles attract each other, like poles repel each other.
6. Magnetism is a force that can pass through air, liquid, and solid.
7. Different magnets have different strength of magnetic force.
8. The poles have the strongest force.
9. A compass is a magnet. One of the two poles always points to the north, which is north-seeking pole. Another one always points to the south.
10. Poles of a magnet can be determined.
11. A magnetic object can be made manually (magnetizing).
12. Magnetism is a field.
13. Electricity can generate magnetism and the poles of an electromagnet can be changed with the change of electric current.

A coding scheme based on the above 13 elements was developed according to the skill theory (Fischer & Bidell, 1998) (please see the Appendix). The skill theory implies a hierarchical progression in human understanding. Thus, the coding scheme defines students' conceptual understanding of magnetism as a hierarchically ordered collection of six levels of conception, each of which contains a number of sub-levels denoted in decimals (i.e., 1.2, 3.2...). The six levels reflect the degree of the structural generality of the magnetism concept. The sub-levels within a level represent the complexity of students' understanding of specific elements of knowledge in relation to magnetism, indicating how a student's conceptual change microdevelopmentally occurs.

For instance, if a student's answer to such a question as "Can the magnet attract the paperclip in water?" was 'yes', the student's current level of conceptual understanding is thought to be 4.3, and the correspondent score is 4.2. If the answer was completely incorrect or no answer was given, that is considered to be no change in terms of level of conceptual change, and the student's level remained at the immediately previous level – level 4.2, and the score at this level is 4.0. If the student's answer was partially correct or uncertain, this is perceived that the student's conceptual understanding didn't completely arrive at level 4.3, but may have moved beyond level 4.2. Thus the student's current level is considered to be between level 4.2 and level 4.3, and the score is 4.1 (the middle point between 4.0 and 4.2).

Each student's performances during a lesson were scored according to the coding scheme. An event was any response by a student that may demonstrate understanding during the instruction. Examples of events were: an answer to a teacher's question, a question posed to the teacher, or an action of manipulating an object. In order to test the inter-rater reliability of the coding scheme, two independent raters scored the transcripts of the students' performances. Because there was an inevitable difference between the two raters in their understanding of student performances, and the events coded for each session were not always the same. The agreement on coded events was 89.7% between the two raters. The Pearson correlation coefficient between the scores by the two raters for the same events was 0.87. Because of the high agreements between the two raters on both events and scores of the events, a final set of events and scores were obtained by resolving the disagreement between the two raters.

Data Analyses

To answer the first research question, individual growth trajectory analysis (Fischer & Bidell, 1998; Yan, 2000) was conducted to identify the shapes of individual developmental trajectories. Individual trajectory analysis is a method for representing, describing, and analyzing each individual's performance sequences. Because four students were involved in the study, and each student took part in the same task during each session, there were four individual microdevelopmental trajectories for each learning activity. Because each student was involved in a total of four problem-solving activities, 16 microdevelopmental trajectories were obtained. Based on all the intra-individual and inter-individual trajectories, typical trajectories were identified, so was the general trend of the microdevelopmental pattern of change for each student. The comparison of 16 trajectories formed the bases for answering the second research question using van Geert's Vygotskian dynamic ZPD model.

The van Geert's model (1994) consists of a group of difference equations rather than differential equations; the latter is commonly used in the sciences like physics. Van Geert thinks that a discrete process simulating discrete learning levels better models development. There are two basic equations: one describes changes in the actual development (A), while the other accounts for potential development (P). They form the core of the mathematical model of Vygotsky's ZPD concept of learning. The two basic equations are:

$$A_{i+1} = A_i \left(1 + R_{A_i} - R_{A_i} \times A_i / P_i \right) \quad (1)$$

$$P_{i+1} = P_i \left(1 + R_{P_i} - R_{P_i} \times P_i / K \right) \quad (2)$$

Equation (1) represents a discrete process of a student's actual microdevelopment at time 1, 2, ..., $i, i+1, \dots$ where any next state of variable A is the function of its preceding state. A_{i+1} is the level of variable A at the observation point $i+1$; R_{A_i} is the growth rate of A at the point i . It should be noted that in equation (1) P_i is the potential level at the point i that is treated as the equilibrium level or carrying capacity of the learning and instruction, i.e. the state of instruction at that point. As a result, equation (1) relates students' actual development to the potential development by making P_i the attractor point for A_i . In this model, P_i is not a constant; it is defined in the context of instruction. P_i is driven toward the educational goal state. This drifting process is not only student-dependent, but also goal-dependent.

Equation (2) illustrates how the potential development changes according to Vygotsky's ZPD model. In the equation, P_i is the level of P at time i , and R_{P_i} is the rate of change of P. K is the goal state in a specific instruction context. This model assumes that A shifts toward the current P level, and P should move toward K. Thus, there are two different goal states distinguished in the model. One is the 'ultimate' goal K that acts as the final attractor state of the acquisition process. The second goal state is the local, context-dependent goal, which is present in the form of the current level of potential development, namely P_i in equation (1). The local goal state (P_i) depends on both the final goal, and the student's current ability and

understanding, in other words, the student's current level of actual development (A_i) (see Equation 3 below). Equations (1) and (2) are dependent on one another. Vygotsky regards the growth of both P and A as a product of their reciprocal interactions.

According to van Geert (1994), it is assumed that instruction varies in how the optimal distance between A and P is defined. For instance, an instructor who believes in small instructional steps may prefer to define the optimum level of P as very close to A. In contrast, another instructor who favors the student's free and unconstrained initiative may define a very broad ZPD with a considerable distance between A and P. In most cases, instructors need to adapt their optimum to the student's optimum. Maintaining an optimum distance between P and A implies that, when P is either too far ahead of or too far behind A, instructor should try to return to that optimum. As a result of the above rationale, R_{P_i} should be a function of both A and P.

In the van Geert's model, the third and fourth equations address that optimum maintaining. They are:

$$R_{P_{i+1}} = r_p - (P_i / A_i - o_p) \times d \times (1 - P_i) \quad (3)$$

$$R_{A_{i+1}} = r_A - |(P_i / A_i - o_A)| \times e \times (1 - P_i) \quad (4)$$

In equation (3), r_p is a constant growth factor on which the growth rate of P at time $i+1$ ($R_{P_{i+1}}$) is adjusted according to the P/A at that time. o_p is a constant parameter specifying the optimal P/A ratio. The constant parameter d acts as a damping factor, which allows one to experiment with different ways in which the optimum value may affect the learning process. The default is that d is equal to r_p . By the same rationale, the student also has an optimum distance between A and P, which promotes maximum learning. Equation (4) specifies how the optimum affects the growth rate of the actual developmental level. In equation (4), $R_{A_{i+1}}$ is the growth rate of A at time or event $i+1$, r_A is a constant growth factor, P_i is the level of P at time i , A_i is the level of A at time i , o_A is a constant parameter specifying the optimal P/A ratio, e is a constant parameter that acts a damping factor. The absolute value in equation (4) is required because A grows towards its optimum via the specified equilibrium level P, as specified in equation (2). Van Geert (1994) suggested that optimality parameters, o_A and o_p , take a value slightly greater than 1, for instance 1.2.

The combination of equations (1), (2), (3), and (4) forms the mathematical model of Vygotsky's ZPD concept of learning. It is a dynamic model in that it describes the reciprocal interaction of the basic variables – actual and potential developmental levels – over time. Actual and potential levels define and specify each other with the support of a set of mediating variables: rates of change of both actual and potential levels, the goal state level, optimality parameters, and parameters damping the effect of the latter.

RESULTS

Microdevelopmental Trajectories

Because four students were targeted in the study, and each student took part in the same task during one session, there have been four individual microdevelopmental trajectories for each learning session. Also because each student was involved in a total of four problem-solving activities on learning magnetism, 16 microdevelopmental trajectories were obtained.

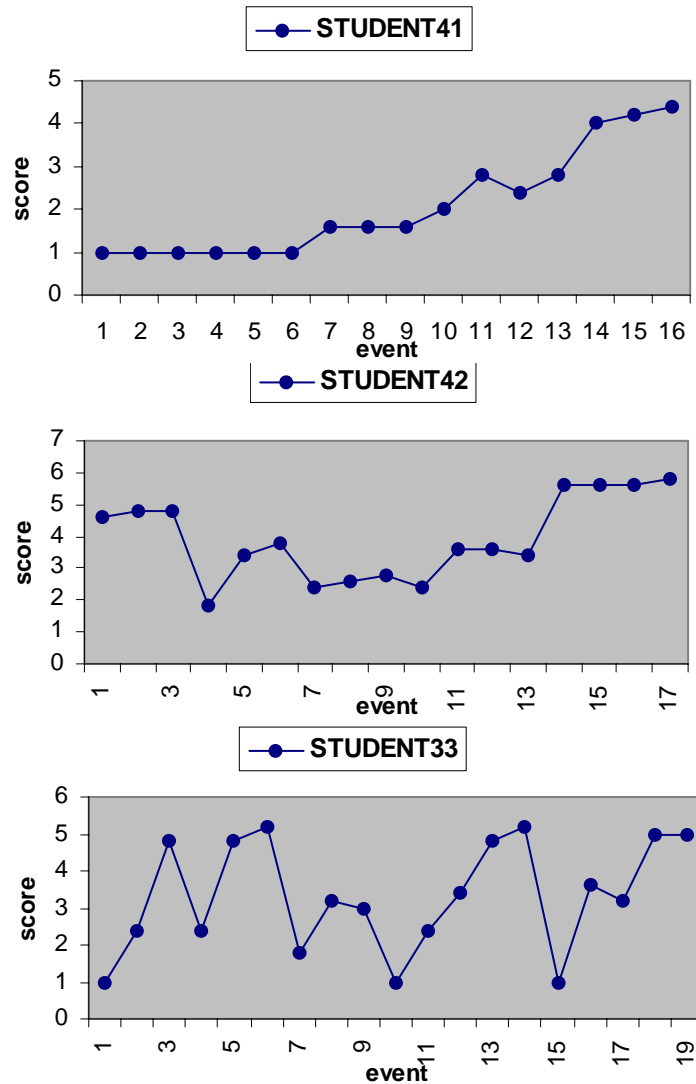


Figure 1. Three prototypical microdevelopmental trajectories: S-shaped growth (STUDENT41), U-shaped growth (STUDENT42), and irregular oscillation (STUDENT33).

Because of the space limitation, we do not display all of the 16 microdevelopmental trajectories here. Based on all the intra-individual and inter-individual trajectories, we

identified typical trajectories among the 16 microdevelopmental trajectories, and the general trend of the microdevelopmental pattern of change for each student over time. Overall, the 16 trajectories can be grouped into three types: (a) 7 trajectories that approximate a logistic or staircase shape showing a steady increase in conceptual understanding, namely, S-shaped growth (e.g., student #4 session #1, noted as STUDENT41), (b) 5 U-shaped growth showing an apparent regression in the course of change before reaching the attractor (e.g. student #4 session #2, noted as STUDENT42), and (c) 4 trajectories that approximate a constant oscillation indicating an un-sustained conceptual understanding (e.g., student #3 session #3, noted as STUDENT 33). Figure 1 presents the three typical conceptual change trajectories.

Dynamic Mechanism behind Microdevelopment

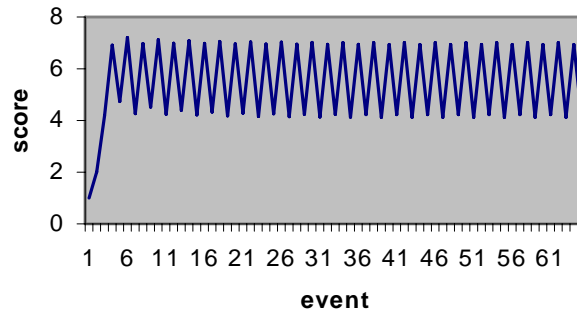
According to Gershenfeld (1999), there are two kinds of simulation in dynamic modelling research: empirical simulation and theoretical simulation. Empirical simulation aims to build models to approximate empirical data, and theoretical simulation is to build models to demonstrate theoretical ideas. Specifically, the former is of a data-driven inductive approach from which a general model could be simulated based on a great number of data arisen from a great number of observations. This kind of simulation method is widely employed in natural science and engineering research. Obviously, the amount of the date collected in this study is insufficient for building empirical simulation models on individual development.

We adopted a theoretical simulation approach in this study (Yan, 2000). A theory-driven approach is to demonstrate a dynamic process by building a theoretical model, and van Geert's dynamic ZPD model falls into this kind of simulation. The goal of this study is to find a general pattern resemblance rather than a perfect curve fit.

According to van Geert (1994, 1998), there are two ways to study the dynamics of the model. One is to study the distinct growth curves that the model yields, given different sets of parameter values. For instance, how does the model reach the goal state? Is it a matter of simple linear progression, or of an S-shaped curve? Is there a long quasi-stability, followed by a sudden jump to the goal state? Are there cyclical patterns of change or regression, and if so, what are the conditions under which these occur? The second way is to monitor the outcomes of a representative range of parameter values. The parameters form a control space in which each point represents a combination of unique values for each of the parameters. By filling the space with different values, it is possible to predict the development. In this study, we followed the first way because making predictions was not the interest.

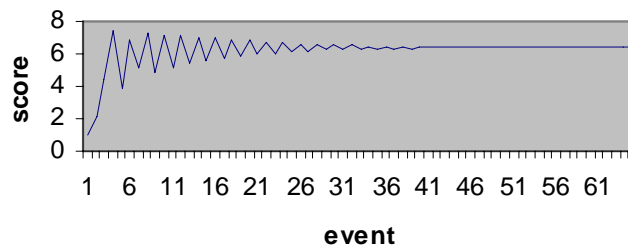
Figure 2 shows simulated trajectories based on van Geert's model. The corresponding parameters associated with each pattern are displayed at the bottom of each trajectory. Rates of change (r_A & r_P) are different across the 3 simulated trajectories. Other parameters are constants: optimality parameters o_P and $o_A = 1.2$, carry capacity $K=6.4$, entrance level of both actual and potential development $A_1 = P_1 = 1.0$, damping factor $e = d = 0.05$.

Regular oscillatory change



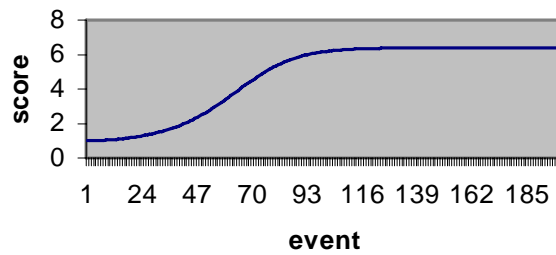
1. $r_A = 1.6, r_p = 2.0, o_A = o_p = 1.2.$

Damped oscillatory change



2. $r_A = r_p = 0.178, o_A = o_p = 1.2.$

S-shape change



3. $r_A = r_p = 0.038, o_A = o_p = 1.2.$

Figure 2. Simulated Trajectories based on van Geert's Model with Different Sets of Control Parameters Showing how the Parameters Affect the Patterns of Growth.

Figure 2 provides three theoretical/simulated microdevelopmental trajectories: *oscillation change*, *damped oscillatory change* (U-shaped), and *staircase shaped change* (S-shaped) for examining a general pattern resemblance between the simulated trajectories and empirical trajectories. These simulated trajectories demonstrate how the mechanism of the reciprocal interaction of the two basic variables (actual and potential developmental levels) in the process of change may determine various dynamic processes over time. Through visual inspection, we can see a general pattern correspondence between the simulated trajectories in Figure 2 and the three types of trajectories described in Figure 1. More specifically, the S-shaped change represents type *a* trajectories – steady increase in conceptual understanding (e.g., STUDENT41), the U-shaped change represents type *b* trajectories – a temporary regression before re-progression in conceptual understanding (e.g., STUDENT42), and the oscillatory change represents type *c* trajectories - un-sustained conceptual understanding (e.g., STUDENT 33).

In all three simulations, the optimum ratio was set to be 1.2 according to van Geert (1994). The difference among the three simulations lied in the rate of learning and the rate of instructor's goal. In simulation #1 (i.e. oscillatory change), both rates were relatively high and are different from each other; in simulation #2 (i.e. damped oscillatory change), both rates were moderate and equal to each other; and in simulation #3 (i.e. staircase change), both rates were small and equal to each other. Thus, when an equally small potential level matched a student's small growth rate, the learning trajectory approached a staircase curve, indicating a relatively steady conceptual increase. However, when both the student and the instructor were changing too fast at different rates (i.e., high rate of change), the trajectory became chaotic, indicating an irregular conceptual change. When both change rates were moderate and equal, after some time's adjustment, the trajectory could become stable, indicating a delayed steady conceptual increase.

DISCUSSION

Before discussing the results in detail, it should be noted that the primary purpose of this study is to employ microdevelopmental methodology to investigate students' conceptual change processes. Although conventional methods have successfully revealed the general patterns of conceptual change (Demaster, Good, & Peebles, 1996), the conditions that lead to conceptual change (Strike & Posner 1985), and some basic factors that influence accomplishment of conceptual change (Pintrich, et al., 1993), we still lack of precisely quantitative information regarding what and how students' conceptual change actually occurs. The results presented above have shown that the microdevelopmental methods can precisely depict the multi-faceted processes of students' conceptual change.

The data of microdevelopmental processes of students' conceptual change in science education are processed under the theoretical framework of nonlinear dynamic system. That non-linear dynamic process is mathematically described in a set of difference equations in van Geert's dynamic Vygotsgian model. The findings associated with dynamic modeling analysis in this study are mainly attained from two sources: the simulated trajectories and the empirical trajectories. The mechanism underlying obtained microdevelopmental trajectories is

obtained by means of comparison and contrast between them. We now discuss some characteristics of this mechanism.

Variability of Path and Rate of Students' Conceptual Change in Learning Magnetism

The obtained microdevelopmental trajectories clearly present that each student went through their unique path of conceptual change over the four learning sessions. Those paths of change also showed a great deal of variability of change within-session and between-session. Although the four students were taught the same content by the same instructor using the same lesson plans, the routes that each of them went through were individual. There were no two absolutely alike trajectories. That means that the students realized their conceptual change through different pathways. The previous studies reported in the literature employing conventional pre- and post-test research designs that typically conclude whether students' conceptions on a science concept on average changed over time, may not be able to uncover the variability in terms of paths of change. For instance, student #1's trajectory in session #3 can be treated a U-shaped curve, which suggests that there was a big regression in her concept learning occurring in session 3. However other three students' trajectories in session #3 appeared to be of chaotic oscillation, which characterizes all the trajectories with session 3. This distinctive shape of path of change cannot be differentiated by the conventional methods. This is one of unique features of microdevelopmental method, since it allows us to intensively observe the tiny steps that students actually undertook toward the instructional goal set by the instructor.

Having closely examined the results regarding the microdevelopmental trajectories obtained in this study, the variability of students' conceptual change processes in learning magnetism is evident in this case. It can be concluded that there are at least three types of microdevelopmental trajectories (as shown in Figure 2) that reflect processes of students' conceptual change: quasi- U-shaped curve, irregular oscillatory curve, and quasi-S-shaped curve. For example, student#1's four trajectories basically can be grouped into two categories: S-shaped and U-shaped curves. By comparing the four obtained trajectories with the simulated one, we can say that student#1's conceptual change process underwent relatively smoother than others, since the other three students' paths of knowledge acquisition include both U-shaped and irregular oscillated trajectories. This inference basically is aligned with the instructor's (the first author) on-site observation of that student's actual learning.

The variability of conceptual change processes is not only seen among the four students, but between the four learning sessions within each student. In other words, this study displays a comprehensive picture embracing both between-subject cognitive variability and within-subject variability. For instance, for student#3, in session #1 her learning curve looks like S-shaped, however, in session #3, the process of learning went quite unstably in the form of an irregular oscillatory curve. The between-subject cognitive variability in learning a scientific concept, in principle, manifests individual differences in cognition that has been prevalently targeted in the contemporary educational and psychological research. However, the significance of within-child cognitive variability, according to Siegler (2007), has been ignored for a long time, since it has been treated "as a nuisance to be minimized – error variance" (p. 105). This is because recent research has revealed that within-child variability is

important – for predicting change, for analyzing change, and for understanding change mechanisms (Siegler, 2007). For example, it can be seen that the subsequent discussion on the mechanism underlying those microdevelopmental trajectories will provide an explanation of the empirical findings such as why for student#3 the learning curve in session #1 is qualitatively different from that in session #3.

Rate of Change – Mechanism Underlying the Microdevelopmental Trajectories

As presented previously, van Geert's Vygotskian dynamic model describes the reciprocal interaction between individual students' actual developmental level and potential developmental level by the various combinations of those control parameters: rates of change of both actual and potential developmental level, goal (i.e., attractor), optimality parameters (i.e., optimal ratio of actual level and potential level, and optimal ratio of change rate of actual level and potential level), etc. Different sets of control parameters represent different contexts of instruction. For instance, the growth rate of the potential level corresponds to the instructor's adaptation to a student's optimum, i.e. the optimal distance between the actual level and the potential level.

The simulation done in this study demonstrates that both growth rates and optimum parameters play a key role in determining shapes of simulated trajectories. As a parameter in a dynamic growth system, the growth rate is defined as a ratio between two successive growth levels (van Geert, 1994). For instance, a growth rate is 0.2 when the previous growth level is five times smaller than the present growth level. It is evident that the growth rate and optimum parameter are the most influential parameters in the model. Oscillatory trajectories are associated with the extraordinary growth rates and optima (too high or too low). That means that the trajectory could be oscillatory in the cases of both low growth rates and high optimality parameters, or both high growth rates and low optimality parameters. The findings suggest that the critical condition under which the smooth S-shaped curves were generated is that both growth rate parameters and optimality parameters are close to their ideal values. This finding implies that keeping cognitive growth on a smooth track requires both reasonably moderate growth rate parameters and optimality parameters (not too high or not too low), i.e., an optimal correspondence between students' pace of learning and the pace of instruction.

As mentioned in the result section, the comparison and contrast between the simulated trajectories and the obtained empirical microdevelopmental trajectories suggests the basic mechanism underlying the 16 obtained trajectories – dynamic reciprocal interaction between the actual developmental level and the potential developmental level. The actual level and potential level essentially determine each other. The four one-on-one instructional sessions were conducted in a way that the level of sub-concepts of magnetism and the pace of the instruction were frequently adjusted by the instructor in order to adapt to each individual's degree of learning. The similarity between the actual instruction and van Geert's dynamic ZPD model suggests that the dynamic reciprocal interaction between the actual developmental level and the potential developmental level is the mechanism underlying those microdevelopmental trajectories. In other words, the dynamic interaction between the control parameters containing the van Geert's dynamic ZPD model (i.e., the parameters in the four

difference equations) plays a determining role in resulting in the between-subject and within-subject cognitive variability of microdevelopment of conceptual change. In our view, this kind of interaction among those control parameters essentially accentuates the interaction of learners' individual difference variables such as prior knowledge, study strategies, motivation, interest, task value, and so on, with teachers' instructional parameters such as instructional objectives, pace of instruction, teaching style, and so on. In this sense, it can be said that students' individual difference variables and teachers' instructional parameters interact with each other and formulate a self-organizing system.

CONCLUSIONS

The use of the microdevelopment method and dynamic system theory in this study has enabled us to understand students' conceptual change as a process of dynamic reciprocal interaction between students' actual developmental level and potential level. We have shown that empirical microdevelopmental trajectories display both between-subject and within-subject variability of the path and rate of conceptual change in learning a scientific concept. We have found that the quantitatively different levels of growth rates and optimality parameters in van Geert's model can produce qualitatively different growth patterns of conceptual change. The present study has shown that the microdevelopmental methods can overcome limitations of traditional pre- and post-test approaches in terms of uncovering what actually has occurred in conceptual change processes. Because chaotic oscillatory growth patterns are found to be associated with abnormal growth rates and abnormal optimality parameters, teacher's instruction in terms of pace and difficulty can influence the quality of student learning.

Conceptual change as a self-organizing system represents a fundamental shift in current educational and psychological research from determinism to emergentism philosophically, and from state-oriented approaches to process-oriented approaches methodologically (van Geert, 1997; Granott & Parziale, 2002; Sawyer, 2005). Emergent phenomena in self-organizations depend on the mutual interplaying of a set of contributing influences. Self-organization involves the generation of unpredictable forms (e.g., students' conceptual change trajectories) from interaction of lower-order components. Those lower-order components in a self-organizing system of conceptual change include both students' and teachers' parameters, namely, the growth rate of learning and teaching, instructional goals, and so on. Microdevelopmental or microgenetic research as an emerging research method (Granott, & Parziale, 2002) alongside the dynamic system theory has demonstrated its unique use for further exploring students' complex cognitive processes in science learning.

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APPENDIX: CODING SCHEME FOR ASSESSING MICRODEVELOPMENT OF STUDENTS' CONCEPTUAL CHANGE IN LEARNING MAGNETISM

Diff -- differentiation;
 Int -- integration;
 Sub -- substitution.

Level

Score

1, *Definition: students have some separate initial ideas about magnets and magnetism, and know some simple phenomena regarding a magnet and magnetism. But they have no clear idea about the relation and connection between two or more individual objects, concepts, and phenomena.*

Level 1.1:

[1.0]

Description: students can figure out a specific bar magnet or a horseshoe magnet by its look, and have a general idea about a metal. However, they don't know the variation of metals in terms of magnets.

$\left[\begin{array}{c} \textit{bar} \\ \textit{magnet} \end{array} \right] \textit{or} \left[\begin{array}{c} \textit{horseshoe} \\ \textit{magnet} \end{array} \right] \textit{or} [\textit{metals}]$

Level 1.2:

[1.2]

Description: Students recognise some specific metals, such as a paperclip, loonie, penny, needle, pin, dime, etc.

$$\left[\begin{array}{c} \textit{paperclip} \\ \textit{metal} \end{array} \right] \& \left[\begin{array}{c} \textit{loonie} \\ \textit{metal} \end{array} \right] \& \left[\begin{array}{c} \textit{needle} \\ \textit{metal} \end{array} \right] \& \left[\begin{array}{c} \textit{penny} \\ \textit{metal} \end{array} \right] \& \dots$$

Level 1.3: [1.4]

Description: Students conclude that there are various magnets in terms of size and shape from their perceptions on bar magnets, horseshoe magnets, and compasses, etc.

$$\text{Int} \left(\left[\begin{array}{c} \textit{bar} \\ \textit{magnet} \end{array} \right] + \left[\begin{array}{c} \textit{horseshoe} \\ \textit{magnet} \end{array} \right] + \dots \right) = \left[\begin{array}{c} \textit{size} \\ \textit{magnets} \\ \textit{shape} \end{array} \right]$$

Level 1.4: [1.6]

Description: Students know the fact that some objects are made of iron and steel, but cannot relate it to magnetism.

$$\text{Diff} \left[\begin{array}{cc} \textit{iron} & \textit{non-iron} \\ \textit{objects}, & \textit{objects} \\ \textit{steel} & \textit{non-steel} \end{array} \right] = \left[\begin{array}{c} \textit{iron} \\ \textit{objects} \\ \textit{steel} \end{array} \right], \left[\begin{array}{c} \textit{non-iron} \\ \textit{objects} \\ \textit{non-steel} \end{array} \right]$$

Level 1.5 [1.8]:

Description: Students know that a compass is a magnet.

$$\left[\begin{array}{c} \textit{compass} \\ \textit{magnet} \end{array} \right]$$

2, *Definition: Students have established initial relations between two or more objects or concepts, and intentionally apply those relations to solve some simple problems.*

Level 2.1: [2.0]:

Description: Students use such plain language as ‘stick’, ‘pick up’ instead of ‘attract’ to describe the event happening between a specific magnet and some metals.

$$\left[\begin{array}{c} \textit{bar} \\ \textit{magnet} \end{array} \frac{\textit{stick}}{\textit{pickup}} \textit{metals} \right] \textit{or} \left[\begin{array}{c} \textit{horseshoe} \\ \textit{magnet} \end{array} \frac{\textit{stick}}{\textit{pickup}} \textit{metals} \right] \textit{or} \dots$$

Level 2.2: [2.2]

Description: Students can use ‘attraction’ instead of plain language to describe the event happening between a specific magnet and some metals, but don’t know another basic phenomenon ‘repulsion’.

$$\left[\textit{magnetA} \frac{\textit{attraction}}{\textit{attraction}} \textit{magnetB} \right] \& \left[\textit{magnets} \frac{\textit{attraction}}{\textit{attraction}} \textit{metals} \right]$$

Level 2.3: [2.4]

Description: When asked to identify if an object is a magnet, students can intuitively relate the object to metals, but they don't know that not all metals can be used to do so.

$$\left[\begin{array}{c} \text{bar} \\ \text{magnets} - \text{metals} \\ \text{horseshoe} \quad \text{all} \end{array} \right]$$

Level 2.4: [2.6]

Description: Students understand that 'attraction' only occurs between some specific metals and all the magnets. But they can not relate those metals that can be attracted by magnets to the objects of iron and steel.

$$\left[\text{magnets} \xrightarrow{\text{attraction}} \text{metal} \right]_{\text{paperclip}} \& \left[\text{magnets} \xrightarrow{\text{attraction}} \text{metal} \right]_{\text{loonie}} \dots \& \left[\text{magnets} \xrightarrow{\text{non-attraction}} \text{metal} \right]_{\text{penny}}$$

Level 2.5: [2.8]

Description: Students can distinguish the features of the objects that are made of or contain iron and steel, and understand that only those objects being made of or containing iron and steel can be attracted by magnets.

$$\text{Diff} \left[\begin{array}{c} \text{iron} \quad \text{copper} \\ \text{metals} \& \text{metals} \\ \text{steel} \quad \text{others} \end{array} \right] = \left[\text{magnets} \xrightarrow{\text{attraction}} \text{metals} \right]_{\text{steel}}^{\text{iron}}, \left[\text{magnets} \xrightarrow{\text{non-attraction}} \text{metals} \right]_{\text{others}}^{\text{copper}}$$

3. Definition: Student have a clear understanding of the relations between two or more objects and concepts that subsume a number of simple individual objects and concepts, and can solve *more complex problems. They also grasp more detailed differentiation of the features of those relations. At this level, students have a preliminary idea of 'poles'.*

Level 3.1: [3.0]

Description: Students can differentiate the poles by the looks of the ends of a specific magnet.

$$\text{Diff} \left[\begin{array}{c} \text{'N'} \quad \text{'S'} \\ \text{look, look} \\ \text{red} \quad \text{blue} \end{array} \right] = \left[\begin{array}{c} \text{northpole} \\ \text{magnet} \\ \text{bar} \end{array} \right], \left[\begin{array}{c} \text{southpole} \\ \text{magnet} \\ \text{bar} \end{array} \right] \text{ or}$$

$$\text{Diff} \left[\begin{array}{c} \text{'N'} \quad \text{'S'} \\ \text{look, look} \\ \text{red} \quad \text{blue} \end{array} \right] = \left[\begin{array}{c} \text{northpole} \\ \text{magnet} \\ \text{bar} \end{array} \right], \left[\begin{array}{c} \text{southpole} \\ \text{magnet} \\ \text{bar} \end{array} \right]$$

Level 3.2: [3.2]

Description: Students realize that every magnet has two poles, but they don't know how to identify them. They have some basic knowledge about a compass (one of the two poles always points to the north).

$$\text{Int} \left(\begin{bmatrix} \textit{poles} \\ \textit{magnet} \\ \textit{bar} \end{bmatrix} + \begin{bmatrix} \textit{poles} \\ \textit{magnet} \\ \textit{horseshoe} \end{bmatrix} + \begin{bmatrix} \textit{poles} \\ \textit{magnet} \\ \textit{compass} \end{bmatrix} + \dots \right) = \begin{bmatrix} \textit{magnets} - \textit{poles} \\ \textit{all} \end{bmatrix}$$

Level 3.3: [3.4]

Description: Students generalize the concept of 'like poles' and 'unlike poles' from the pairs of north pole and south pole of two magnets.

$$\text{Int} \left(\begin{bmatrix} \textit{northpole} - \textit{northpole} \\ \textit{magnetA} \quad \textit{magnetsB} \end{bmatrix} + \begin{bmatrix} \textit{southpole} - \textit{southpole} \\ \textit{magnetA} \quad \textit{magnetB} \end{bmatrix} \right) = \begin{bmatrix} \textit{likepoles} \\ \textit{magnets} \end{bmatrix}$$

$$\text{Int} \left(\begin{bmatrix} \textit{northpole} - \textit{southpole} \\ \textit{magnetA} \quad \textit{magnetB} \end{bmatrix} + \begin{bmatrix} \textit{southpole} - \textit{northpole} \\ \textit{magnetA} \quad \textit{magnetB} \end{bmatrix} \right) = \begin{bmatrix} \textit{unlikepoles} \\ \textit{magnets} \end{bmatrix}$$

Level 3.4: [3.4]

Description: Students relate 'attraction' to the interaction between a north pole and a south pole of two magnets or compasses, and relate 'repulsion' to interaction between two north poles or two south poles of two magnets or compasses. They don't apply 'unlike poles' and 'like poles' in those cases.

$$\begin{bmatrix} \textit{northpole} \xrightarrow{\textit{attraction}} \textit{southpole} \\ \textit{magnetA} \quad \textit{magnetB} \end{bmatrix} \& \begin{bmatrix} \textit{northpole} \xrightarrow{\textit{repulsion}} \textit{northpole} \\ \textit{magnetA} \quad \textit{magnetB} \end{bmatrix} \& \begin{bmatrix} \textit{southpole} \xrightarrow{\textit{repulsion}} \textit{southpole} \\ \textit{magnetA} \quad \textit{magnetB} \end{bmatrix}$$

Level 3.5: [3.6]

Description: Students relate 'attraction' to 'unlike poles', and relate 'repulsion' to 'like poles'. But they don't know how to apply this piece of knowledge to identify the poles.

$$[\textit{attraction} - \textit{unlikepoles}] \& [\textit{repulsion} - \textit{likepoles}]$$

Level 3.6: [3.8]

Description: Students can distinguish the poles of all magnets regardless of size and shape using more than one method according to their understanding of 'like poles' and 'unlike poles'.

$$\text{Diff} \left[\begin{bmatrix} \textit{northpole}, \textit{southpole} \\ \textit{magnets} \quad \textit{magnets} \end{bmatrix} \right] = \left[\begin{bmatrix} \textit{northpole} \\ \textit{magnets} \end{bmatrix} \right], \left[\begin{bmatrix} \textit{southpole} \\ \textit{magnets} \end{bmatrix} \right]$$

4, Definition: Students understand the essence of the concept of magnetism. They come to generalize that magnetism is a kind of force, and understand all the relevant concepts and

phenomena regarding magnets and magnetism under this fundamental concept. Students can solve some tricky problems.

Level 4.1:[4.0]

Description: Students apply the concept of ‘force’ to understand those specific interactions occurring between all the magnets and iron and steel.

$$\left[\begin{array}{ccc} \text{magnets} & \leftrightarrow & \begin{array}{c} \text{iron} \\ \text{metals} \\ \text{steel} \end{array} \\ & & \updownarrow \\ \text{magnetA} & \leftrightarrow & \text{magnetB} \end{array} \right] = [\text{force}]$$

Level 4.2:

[4.0]

Description: Students relate ‘attraction’ and ‘repulsion’ to the ‘force’. But they merely know that magnetic force can pass through air.

$$\left[\begin{array}{c} \text{attraction} \\ \text{magnets} - \text{magneticforce} \\ \text{repulsion} \end{array} \right]$$

Level 4.3:

[4.2]

Description: Students understand that magnetic force can pass through either water or rice. But they can not generalise that specific phenomenon into all the liquids and solids.

$$\text{Sub}[\text{magneticforce} - \text{air}] = [\text{magneticforce} - \text{water}]$$

or

$$\text{Sub}[\text{magneticforce} - \text{air}] = [\text{magneticforce} - \text{rice}]$$

Level 4.4:

[4.4]

Description: Students conclude that magnetic force can pass through air, liquid, and solid.

$$\left[\text{magneticforce} - \begin{array}{c} \text{liquid} \\ \text{air} \\ \text{solid} \end{array} \right]$$

Level 4.5:

[4.6]

Description: Students can conclude that the poles of magnets have the strongest force, and the strength at the middle part of a magnet is the weakest.

$$\text{Int} \left(\left[\begin{array}{c} \textit{middle} - \textit{paperclips} \\ \textit{less} \end{array} \right] + \left[\begin{array}{c} \textit{poles} - \textit{paperclips} \\ \textit{more} \end{array} \right] \right) = \left[\begin{array}{c} \textit{force} \\ \textit{middle} \\ \textit{weakest} \end{array} \right], \left[\begin{array}{c} \textit{force} \\ \textit{poles} \\ \textit{strongest} \end{array} \right]$$

Level 4.6: [4.8]

Description: Student can understand that the strength of magnetic force with a magnet is not necessarily proportional to its size, a bigger magnet could be weaker than a smaller one in terms of force.

$$\left[\begin{array}{cc} \textit{stronge} & \textit{shape} \\ \textit{force} - \textit{magnets} & \\ \textit{weak} & \textit{size} \end{array} \right]$$

5, Definition: Students' conception on magnetism expands from permanent magnets to temporary magnets. They come to know how to magnetise iron and steel from magnets.

Level 5.1: [5.0]

Description: Students understand that a needle or a steel knife can be made into magnets, but they don't know how to make a compass using a needle, and have no idea about the meaning of 'magnetizing'. They also understand that a magnetized needle is a temporary magnet.

$$\left[\begin{array}{cc} \textit{needle} - \textit{needle} & \\ \textit{nonmagnet} & \textit{magnet} \end{array} \right]$$

Level 5.2: [5.2]

Description: Student can make a needle into a compass, and understand that this is a case of magnetising.

$$\left[\begin{array}{c} \textit{needle} \xrightarrow{\textit{magnetized}} \textit{compass} \\ \textit{nonmagnet} \end{array} \right]$$

Level 5.3: [5.4]

Description: Students recognize from a specific case that iron and steel can be magnetized, but they don't have a generalization that all the magnetic objects can be magnetized.

$$\left[\begin{array}{c} \textit{iron} \\ \textit{metals} - \textit{magnetizing} \\ \textit{steel} \end{array} \right]$$

Level 5.4: [5.6]

Description: Students can properly relate 'magnetic objects' (that is defined as the objects that can be attracted by magnets) to 'magnetizing'.

$$\left[\textit{magneticobject} - \textit{magnetizing} \right]$$

Level 5.5: [5.8]
 Description: Students can differentiate permanent and temporary magnets.

$$\text{Diff} \left[\begin{array}{cc} \textit{magnets}, \textit{magnets} \\ \textit{temporary} \quad \textit{permanent} \end{array} \right] = \left[\begin{array}{c} \textit{magnets} \\ \textit{temporary} \end{array} \right], \left[\begin{array}{c} \textit{magnets} \\ \textit{permanent} \end{array} \right]$$

Level 5.6: [5.8]
 Description: Student can understand that the north pole of a compass is actually the south pole of the magnet.

$$\left[\begin{array}{c} \textit{compass} - \textit{earthmagnet} \\ \textit{poles} \end{array} \right]$$

6, *Definition: In this case, students know through a descriptive experiment that electricity can generate magnetism. Further details are beyond the scope of the teaching.*

Level 6.1: [6.0]
 Description: Students previously know that battery can generate electricity. They observed that an iron bolt can become a magnet while it connects to a battery via wires.

$$[\textit{magnetism} - \textit{electricity}]$$

Level 6.2: [6.2]
 Description: Students understand that electromagnet is a temporary magnet.

$$\left[\begin{array}{c} \textit{electromagne} - \textit{magnets} \\ \textit{temporary} \end{array} \right]$$

Level 6.3: [6.4]
 Description: Students accept the fact that the poles of an electromagnet can be changed with the change of current direction.

Chapter 6

PHONOLOGY, DISCREPANCY, INSTRUCTION AND DYSLEXIA: ADVERSARIES OR ALLIES?

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ABSTRACT

This chapter will consider recent debates about educational psychology assessments. Although work in the UK will form the basis of the discussion, the arguments should be seen to be relevant to educational practices around the world and the evidence covered will be multinational. The discussion focuses on issues related to literacy development and the identification of literacy learning difficulties (dyslexia) and, therefore, the chapter will review the debate on the validity and reliability of IQ-achievement discrepancy criteria as a way of identifying specific literacy learning weaknesses and alternative positions arguing for practices that adopt narrow behaviourist models in terms of their theoretical explanations and educational input. Definitions of dyslexia that encompass all word level literacy weaknesses will also be covered and evidence will be presented for phonological skills being a key component to literacy development and for the power of instructional techniques in education. The chapter will consider cognitive assessment procedures that evaluate a range of skills (literacy, phonological processing, verbal and non-verbal reasoning, semantic, vocabulary and visuo-spatial skills) possessed by the individual and the potential advantages of such procedures for the identification of appropriate intervention strategies. This background will be used to propose that progress in the provision of a range of interventions that can be used effectively with all learners requires a recognition of the complementary nature of these views and argues for research to assess the efficacy of this complementary perspective. It will also be used to argue for the need for investigations that recognise the overlap and relationships between usual development and a spectrum of learning difficulties. The focus of the chapter is an appeal for the need to combine the roles of individual differences and instructional

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precision in education as well as research investigating the efficacy of using these perspectives in combination.

INTRODUCTION

The assessment of Specific Learning Difficulties or Developmental Dyslexia (dyslexia in this chapter) has been an area of controversy within education and psychology for many years. The debate has concentrated on the validity of identifying a difficulty through a discrepancy between general ability and literacy development, and problems with the reliable assessment of an individual's development and abilities within cognitive areas that may relate to proficiency in literacy and acquiring literacy. Such problems have led to the alternative viewpoint, which is to simply address the effective teaching of literacy skills (see Solity et al, 2000). The present chapter argues that the assessment of a range of skills including, but not exclusive to literacy, is a key component in identifying the most effective intervention for the individual learner. Therefore, the aim is to advocate for the continued use of broad skills assessment and cognitive profiling procedures. These procedures will include measures of literacy, but also the underlying cognitive factors that appear implicated in the development of literacy difficulties (such as phonological processing) and those which play a role in producing variability in the acquisition of literacy (such as compensatory factors within visual skills and semantic processing). Procedures used for this skills assessment and cognitive profiling will continue to be the basis of debate, research and modification, as our understanding of human cognitive development extends. However, even in their present form, such procedures provide valuable information for the educationalist to target appropriate learning techniques and for the extension of theoretical models of development.

IQ AND DISCREPANCY METHODS OF ASSESSMENT

A traditional, and the most common, way of identifying specific literacy problems has been to use an IQ-achievement discrepancy. One argument against the individual skills assessment/cognitive profiling approach has been the loss of confidence in this discrepancy approach (see Siegel and Lipka, 2008). There are many ways to determine a discrepancy that may be used to determine atypical development or a learning disability; however, the most common method, and the one often referred to by the term 'discrepancy criterion', is that which compares reading ability with IQ-predicted ability. If there is a discrepancy between IQ predicted reading level and actual reading level, such that the latter is considered significantly lower than the former, then the individual is assessed as dyslexic. The basis of this discrepancy view is that low IQ leads to poor functioning in various skills, including reading, and, under exclusionary criteria, those with poor reading skills due to similarly low IQ should be rejected from the group with specific reading difficulties. This view has a long history and is based on definitions of dyslexia such as that of World Federation of Neurology which proposed that dyslexia is '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' (World Federation of Neurology, 1968, cited in Critchley, 1970).

However, there are several assumptions in this definition that can be questioned. The first is that we can accurately measure IQ independently of other, potentially dyslexia-related, factors. There are still unresolved debates over single versus multiple forms of intelligence and the influence of cultural factors on IQ scores; both of which may question the use of IQ with any group of students (see arguments in Reed, 1999). Additionally, there are specific aspects of dyslexia that may make measures of global IQ even more unsatisfactory amongst this population. For example, Miles (1996) argues that dyslexics are 'strong on some tasks and relatively weak on others' (page 177). Combining scores to produce a global IQ may mean that we underestimate the potential of the child and lead to the conclusion that the child is not dyslexic, but rather is presenting reading skills commensurate with their intellectual abilities. For example, there is a great deal of evidence that children assessed as dyslexic perform well on certain sub-scales of the Wechsler Intelligence Scale for Children (WISC) but poorly on others (Miles, 1996; Rugel, 1974; Thomson, 2001; Vargo et al, 1995). Combining all WISC sub-test scores in a global Intelligence Quotient would seem to include the specific areas of disability. A child's IQ estimate may vary greatly depending on whether these specific areas of weakness are included in the IQ estimate or not. Similarly, the way IQ scores are used in dyslexia assessments varies across practitioners (see discussions in: Dombrowski, Kamphaus & Reynolds, 2004; Francis et al, 2005; Kaufman, 1994; Proctor and Prevatt, 2003; Turner, 1999; Wright and Groner, 1993), based on different views as to the usefulness and validity of the measurements used, thus making interpretation and comparison of results difficult.

The second problem with the IQ/reading discrepancy procedures is the view that low IQ leads to poor reading ability. Again, this assumption has been questioned. For example, Stanovich (1991; 1996) argues that poor language skills lead to problems with phonological processing which negatively impact on word recognition and, hence, reading ability. Intelligence plays no part in this causal pathway and, therefore, high IQ and low IQ poor readers should be treated identically since both suffer the same underlying causes of their difficulties with learning to read; although it could be argued that this does not take account of the association between poor language skills and low verbal ability, and the view that the latter might usefully be applied as indicative of the former (see discussions in Tiu, Thompson and Lewis, 2003).

In an attempt to avoid problems related to IQ, recent definitions of dyslexia have avoided IQ-based statements. For example, the British Psychological Society (1999) adopted the broad view that dyslexia is evident from a marked and persevering difficulty in word level literacy development. This stance offers a secure standpoint for practitioners, but may not reflect current evidence for group and individual differences. One potential problem with the BPS definition is that a view of dyslexia that encompasses all specific learning difficulties that lead to a literacy deficit may restrict advances in both theory and practice. Comparisons of the factors related to literacy deficits found amongst dyslexics and those with general speech and language problems (Bishop and Snowling, 2004), or others with emotional/behavioural and/or attentional problems (Barkley, 2006; Rutherford, Quinn and Mathur, 2004), may inform theoretical positions as to the causes of variability in literacy skills and their acquisition. Similarly, it may be important to treat these groups differently in terms of (i) the primary focus of intervention (such as specific to literacy or more generally to

language or behaviour), (ii) aspects of the curriculum (such as supporting literacy within a usual curriculum, or redefining the curriculum to accommodate and develop general language) and (iii) the literacy remediation strategy adopted (such as phonologically based, visually based, or multisensory). Education should encompass all such potentially divergent groups. At the very least, research needs to show that such groups produce the same results in studies of educational attainment and intervention.

Phonology as a Key Feature in Literacy and Dyslexia

There is considerable evidence and agreement that phonological skills are a significant factor in children successfully developing word level literacy skills; see, for example, Adams (1990), Bradley and Bryant (1985), Frith (1995), Shankweiler and Crain (1986) and Snowling (2000). Indeed, there is evidence for a significant phonological component in the initial stage of learning to read (Adams, 1990; Cataldo and Ellis, 1988; Ehri, 1992). Nonetheless, the key features of phonology that are essential to early word reading remain a focus for discussion and research: see discussions in Goswami and Bryant (1990), Muter et al (1998), Bryant (1998) and Hulme et al (1998) on whether children progress through different levels of phonological skills, including an onset-rime level of syllable division, or whether they are able to work at a phoneme level immediately upon starting the process of learning to read – and see also the cross-language studies that suggest differing relationships between literacy and phonology (Everatt, Smythe, Ocampo and Gyarmathy, 2004; Goswami, 2000; McBride-Chang, Bialystok, Chong and Li, 2004). These issues are important to screening out children at-risk, and may aid in the development of effective literacy programmes for all young children; see, for example, Goswami (1994) and Solity (2000). However, difficulties in phonological processing continue to be associated with literacy weaknesses and dyslexia throughout development and into adulthood (Beaton, McDougall and Singleton, 1997) and may be common to most languages/orthographies (Zeigler and Goswami, 2005).

The importance of phonology to early reading and spelling is confirmed by a range of studies that offer controlled and well-managed investigations of the effects of building accuracy and fluency in phonology in young children. There is a considerable consistency in the finding that early phonological training, together with suitable linkage to early orthography and literacy experience, improves word literacy, and that such improvements remain evident within later adolescent ages. See, for example, Bradley and Bryant (1985), Hatcher et al (1994), Iversen and Tunmer (1993) and Torgesen (2004). Such studies offer considerable support to a causal relationship between phonological skills and early word reading and spelling (a point that will be re-emphasised in the Intervention Studies section that follows).

Dyslexics Versus Poor Readers

A third area where IQ/reading age discrepancy methods have been criticised. Evidence has been used to support the view that there is little or no difference between high IQ and low IQ poor readers in all except the measures on which the IQ score was derived (see Ellis et al, 1996; Share, 1996). Where differences have been found, these have been suggested as

unreliable or unconnected with the cause of the reading difficulty. Share (1996) did find differences between high IQ and low IQ poor readers in one out of twenty-six separate reading-related measures, but concluded that this difference was more likely to be due to a type I error than an actual difference. Similarly, although Stanovich (1988) argues that all poor readers should be considered as having a common causal deficit, he also proposes that differences between high IQ and low IQ poor readers will be found in areas such as vocabulary, general knowledge, memory and comprehension.

However, despite common causal pathways to literacy deficits, these differences in the profile of the dyslexic may lead to variations in the manifestations of literacy difficulties and divergent outcomes from intervention. There is evidence that the context within which a word is placed can aid the recognition (speed and accuracy) of that word; for example, studies where subjects are required to name a word such as SNOW following a sentence context of 'The skiers were buried in the ...' (Stanovich and West, 1983). Such context priming effects have been found to be greater amongst dyslexics than reading-age matched controls (see Nation and Snowling, 1998) despite the usual finding that dyslexics present poorer phonological-based decoding skills than these controls (Frith and Snowling, 1983). The use of semantic/syntactic features may provide a compensatory process for poor phonological decoding skills and, hence, behavioural manifestations of dyslexia (such as reading performance) will be as much a factor of these compensatory strategies as the underlying deficit. A similar argument can be made in terms of the strategy-based effects of vocabulary, which may explain findings indicating the use by dyslexics of known word analogies to read unfamiliar letter strings (nonwords) compared to low IQ poor readers' (MLD children's) attempts to apply faulty phoneme correspondences to read the same unfamiliar items (Spagna, 1996). Similar compensatory strategies may be found in dyslexics with proficient visual processing skills (Snowling, 2000). The assessment of verbal IQ related factors of semantic comprehension and vocabulary, as well as visual skills, should inform assessors of such potential areas of compensation, thereby clarifying observed reading behaviours and potential strategies for learning. For example, better performance in text reading compared to single-word reading may be due to compensatory strategies related to semantic and vocabulary factors, whereas the reverse pattern would be more likely to correspond to lower functioning in areas of semantic skills and vocabulary (see also Nation and Snowling, 1999; Stothard and Hulme, 1996). Corresponding evidence from tests of phonological skills, verbal reasoning and vocabulary can be used to distinguish those with literacy deficits associated with dyslexia from those with specific comprehension deficits.

A Spectrum of Learning Difficulties

The nature of learning difficulties requires clarification and may be the source of considerable uncertainty and mis-analysis within the literature. Education, psychology and medicine have long-moved from rigid syndromes and symptoms by which to establish diagnoses and treatments, to much more fluid and interactive assessments, profiles and interventions. Many learning difficulty and educational labels may be regarded as offering an averaged description of someone's cognitive, literacy and educational strengths, weaknesses and needs. They are dimensional features that overlap and may be clarified through diagrammatic form (see figure 1). This inevitably leads to simplification and some errors in

representing multi-dimensional features (eg, certain types of comorbidity are difficult to represent in such a figure), as well as being open to considerable debate on the grounds of theoretical perspectives and evidence. However, such representations show the problem of focusing on learning difficulties as independent entities and provide a framework upon which further research into the relationships and overlaps between different types of educational needs can be devised.

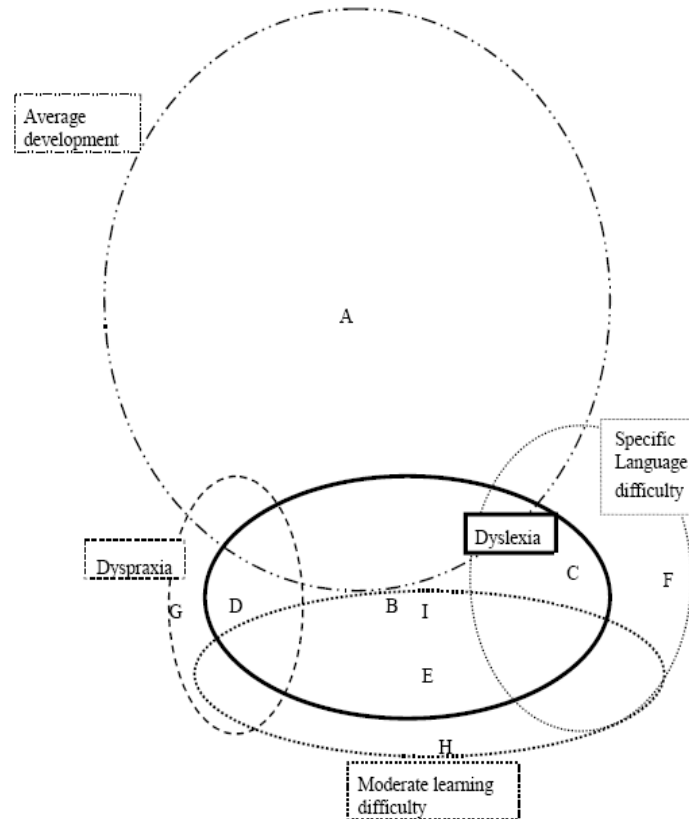


Figure 1. Representation of the overlap between typical development and different specific learning difficulties.

The framework represented by figure 1 shows the range of normal development overlapping with all difficulties other than moderate learning difficulties (MLD), which is the UK term for below average range development and would include many in the poor readers category discussed above. Dyslexia is represented as a sub-group of language difficulties based on the perspective that characteristic cognitive weaknesses amongst dyslexics will be shown in their phonology. Individuals with specific language difficulties may well show these weaknesses; however, these will be most likely accompanied by broader problems in language areas such as vocabulary, syntax and comprehension (Bishop and Snowling, 2004; Catts, Fay, Tomblin and Zhang, 2002; Gillon, 2004; Goulandris, Snowling and Walker, 2000). Dyspraxia in this model is regarded as containing people with central processing weaknesses in visual and motor skills, or a non-verbal learning deficit (Cousins and Symth, 2003; Jongmans, Smits-Engelsman and Schoemaker, 2003; Portwood, 1996; Rourke, 1989).

People with dyspraxia may commonly also show relative weaknesses in their phonology and verbal memory (Stackhouse and Snowling, 1992), and investigations remain pertinent into whether such a group suffers their difficulty through some trauma rather than an hereditary route that may be more associated with dyslexia. There is consequently an overlap between dyspraxia and dyslexia in terms of our current understanding of their cognitive and literacy development, and likely responses to intervention (Visser, 2003). Similarly, the MLD group may overlap with the other learning difficulties, and extend beyond the range of these other groups due to extremes in slowness in development, and the associated fracturing of normal developmental patternings and experiences (see Everatt, Weeks and Brooks, 2008).

In order to view differences between such a spectrum of learning difficulty groupings, it is consequently necessary to consider averages and extremes from each dimensional and overlapping group. Samples from all members of each group that are averaged may lead to research results that are similar but which do not reflect the diversity found within the different groups across a range of skills. Such samples may also fail to indicate the potential for extremes of functioning that may be more likely in one learning disabled group than another. The description of such diversity and extremes of performance may be vital for the determination of the most appropriate support to implement in a given context. For example, average dyslexics (B) and average speech and language difficulties that include dyslexia as a sub-group of all language difficulties (I) will show limited differences across many literacy and cognitive features (as shown in figure 1). It is to be expected that there will be more marked differences between average dyslexics (B) and average specific language difficulties (C), as these groups have been divided according to difficulties in broader language abilities and skills, such as severe speech impediment, or limited vocabulary, syntax or comprehension. Average dyslexics (B) and those with moderate learning difficulties (E) may well show quite limited differences. Similarly, the average MLD child and dyspraxic (D) may potentially fall well within the range of the dyslexic group. The ability level and range of literacy, language, visual and motor difficulties in a dyslexic sample will inevitably affect their overlap in literacy and cognitive weaknesses with many children who might be considered to suffer from speech and specific language problems, dyspraxia or moderate learning difficulty.

Research that aims to examine extreme examples within groupings should provide an indication of development and needs that teaching methods and resources should encompass. Studies that focus on samples from average development (A), extreme specific speech and language difficulties (F), extreme dyspraxics (G) and extreme moderate learning difficulties (H) may be of especial interest. Such comparisons will have the added benefit of informing theoretical views of literacy skills and cognitive development. Similarly, differences between dyslexia and moderate learning difficulty may be clarified by research that compares a 'mild' dyslexic sample (in terms of a small discrepancy between their general development and literacy levels) of good ability and a sample of severe moderate learning difficulty. However, the most interesting comparison in demonstrating differences between cognitive and literacy development may be a severe dyslexic sample (in terms of discrepancy between ability and literacy) and a moderate learning difficulty sample matched for literacy levels.

An example may give a useful illustration of these features. In comparison with his or her own general development, a phonological dyslexic will display weaknesses within literacy and phonological skills. These weaknesses may be evident in, for example, reading and spelling, phonological awareness and working verbal memory. In contrast, there may be

corresponding evidence of strengths in the individual's profile, with scores on measures of non-verbal reasoning, visual memory, comprehension skills and vocabulary being average to good in comparison to normative data. A child with MLD may have similarly low attainments in these same literacy and phonological skills, but would be performing at a level consistent with his/her own development in other areas. It is the relative strengths and weaknesses within each child that characterise their cognitive and literacy development, and may impact upon their routes for relative learning success. There is evidence that the dyslexic will respond to spelling instruction based on his or her relative visual and semantic cognitive strengths, whilst the MLD person will react more favorably to carefully differentiated learning using phonological skills (Brooks and Weeks, 1999). Detailed descriptions of such possibilities are presented in Brooks (1995) who discusses RG, a severe phonological dyslexic, and Weeks et al (2002) who compare a child with specific weaknesses in spelling with a child with slower general development. Despite the common feature of difficulties in literacy skills, they are distinguishable in terms of their overall cognitive profile, and in their relative success with different types of intervention.

A final point that requires consideration is the level at which the practitioner interacts with the wider educational community. It is important that psychological models and terms relate to, and take account of, the common perceptions of children, parents, teachers and educational psychologists (Paradice, 2001), as well as the views and requirements of government and justice (Brady, 2004; Clutterbuck, 2000; Friel, 1998). An ability to more accurately define individuals' functioning and extremes of development can produce a brief label to describe their functioning and associated needs. This may provide a useful rapport with common parlance and educational colleagues, as well as identifying causes and types of difficulties, likely remedial methods and support strategies, and necessary resources.

SINGLE CASE RESEARCH

Rather than dealing with heterogeneous groups that may lead to spurious averaging, a more sophisticated model based within fuller cognitive and literacy profiles is suggested. This approach has its routes in cognitive neuropsychology and gains much of its value through seeking to dynamically represent individual differences in processing and development. Hence, researchers have found evidence of cases of Developmental Phonological Dyslexia (Temple and Marshall, 1983) characterised by phonological difficulties, Developmental Surface Dyslexia (Coltheart et al, 1983) or Developmental Morphemic Dyslexia (Seymour and MacGregor, 1984) indicative of problems with accessing whole words or word-units, and Developmental Deep Dyslexia (Johnston, 1983; Stuart and Howard, 1995) where semantic confusions seem to be particularly evident. Similar single cases have been found that present evidence of specific problems in sequencing (Plaza and Guitton, 1997) or visual short-term memory (Goulandris and Snowling, 1991). These areas of difficulty may derive from faulty developmental processes and lead to their own set of characteristic reading difficulties and compensatory strategies.

A process of assessment which ignores these cognitive and literacy differences will be likely to lead to less optimal strategies for intervention and instruction. Snowling (2000) provides a compelling example of how research in this area can help clarify the processes

involved in literacy acquisition, and the diversity of skills and weaknesses presented by children and adults with learning difficulties. One of the main points made by Snowling (2000) is how a child's abilities can be a defining feature of their observed behavioural characteristics. Hence a child with poor semantic skills and/or lower vocabulary may not be able to use these areas to support weak decoding skills. Such features may distinguish the more classically defined dyslexic from those with deep dyslexia characteristics and low IQ scores: the former may use semantics to support decoding, the latter two may not. Similarly, dyslexics with poor phonology may use good visual memory skills to support literacy, whereas the child with additional visual memory impairments cannot. Distinctions between the underlying deficits may provide a basis on which to implement effective support. Howard and Best (1997), for example, argue, again based on extreme case data, that real word reading/spelling can exist even under conditions where phonological skills are poor, particularly in conditions where learning does not stress phonological decoding. Reason and Morfidi (2001) provide interesting examples of the use of single-case experimental design in demonstrating the impact of inputs upon phonological skills in particular, and in carefully monitoring progress across teaching targets and the success of teaching techniques.

INTERVENTION STUDIES

The ultimate test of the efficacy of the models discussed comes through intervention studies. These offer the opportunity for assessing evidence for causal theoretical models and successful education. It has been suggested that a core phonological difficulty can be important in discovering and describing a key cognitive cause for literacy difficulties (Frederickson and Reason, 1995; Frith, 1995). Consistent with this viewpoint, phonological awareness training has been shown to improve the performance of young readers/spellers in many different contexts: Bryant and Bradley (1985) and Hatcher et al (1994) in the UK; Cunningham (1990), Tangle and Blackman (1992) and Torgesen et al (1992) in the US; Byrne and Fielding-Barnsley (1993) in Australia; Warrick et al (1993) in Canada; Olofsson and Lundberg (1985) in Sweden; Lie (1991) in Norway; Elbro et al (1996) in Denmark; Schneider et al (1997) in Germany. However, these methods are not successful with all children, with the best predictors of lack of success being the child's level of intellectual functioning or their initial level of phonological ability (Torgesen and Davis, 1996; Wise et al, 1999). For example, Lundberg (1988) discusses findings indicating that children in the lowest quartile on phonological awareness tasks did not show a great deal of benefit from phonological training. Similarly, even though the eight-week phonological training program used in Torgesen et al's (1992) study proved effective with the majority of children, still some 30% of the sample of at-risk kindergartners failed to show reliable gains in phonological awareness skills. Matching the profile of the child to the type of intervention may provide a way of increasing the likelihood of success with a particular intervention.

There are very few intervention studies that contrast teaching and learning method while, at the same time, considering the participant's profile in enough detail to allow comparisons across different types of learning difficulty. Although some studies have combined these areas, with most concentrating on single cases (Brooks, 1995; Broom and Doctor, 1995; De Partz, 1986 – although see group differences studies by Brooks and Weeks, 1998; Thomson,

1988), the arguments presented in this paper identify a need for further research to assess the efficacy of combining profiling and learning method. Brooks and Weeks (1999) included individual case studies where spellings were learned, and showed associations between cognitive profiles and responses to learning. Extreme single cases of dyslexia and MLD showed different patternings. Dyslexics responded to methods based within the relative strengths in their cognitive profiles. MLD children showed less progress within individual methods, but responded positively to simple word reinforcement and structured phoneme/grapheme association. In contrast to this learned “bottom up” approach, the dyslexics were more successful with “top down” approaches such as sophisticated visualisation techniques, and phonic methods at an onset-rime level that may tap their current level of phonological development. These findings with 6 to 8 year olds are mirrored in Brooks (1995) with a 13 year old severe dyslexic.

In contrast to the single case approach outlined above, Brooks and Weeks (1998) compared 12 to 13 year old dyslexics and MLD children with a spelling age matched control sample. Individuals were carefully described and placed into groups through analysis of their literacy and cognitive development. They were taught matched words to spell by three methods: tracing, phonics and visualisation. The dyslexics and MLD children learned the spellings most successfully by opposite methods. Dyslexics learned best using their visual and semantic processing strengths, whereas children with MLD improved under a carefully differentiated phonic method that allowed them to slowly build learned skills in a structured format.

Dyslexics, children with speech and language difficulties, MLD children, those with sensory deficits (eg, early-onset deafness), children with attentional deficits or behavioural problems, indeed, many children with different types of learning difficulties present evidence of poor literacy skills. However, it is questionable whether the same teaching and learning method would work for all. The role of an assessment should be to aid in the identification of the teaching and learning method that will maximise the learning potential of the individual child. If distinguishing between low and high IQ students (or MLD versus dyslexics) leads to improved outcomes for both groups of individuals, then such a procedure is warranted.

The research outlined in this section is important in establishing the range of learning strategies that our educational population requires, and in meeting individual needs as effectively as possible. Such research is likely to be most discriminating in small-scale studies with careful selection procedures, rather than through large-scale approaches that will average differences across dimensional learning difficulty features. Intervention studies, such as those outlined above, should inform theoretical views of dyslexia and other learning difficulties, as well as influencing educational policies and practices. The current, albeit limited, evidence from intervention studies, as well as findings linking types of learning difficulties with associated cognitive profiles, makes it improbable that the only necessary provisions for all are through clearly structured instruction packages.

INSTRUCTIONAL PSYCHOLOGY

In the UK, there has been a return to the view that teaching procedures, together with the educational environment, determine the incidence, and possibly the level, of learning

difficulties experienced by children in mainstream schools; for example, Solity (2000) argues that 'special educational needs ... reflect the quality of teaching children receive' (page 61). Solity's (2000) work is an example of the more rigorous research in this area, given the inclusion of control groups of children and contrasts with other teaching methods. It comprises an assessment of the use of Early Reading Research (ERR) across school years. A structure to teaching is presented through instructional psychology principles and results indicate impressive gains in literacy and reductions in the number of children who may be regarded as low achievers. However, despite the promising findings and rigour, the reports of these studies do not indicate the amount of support that participating schools received. In order to establish the efficacy of the advocated procedures it is necessary to show that they, rather than a simple increase in resources or attention being drawn to teachers regarding literacy development, are the reasons for the positive results. Similarly, even with the approach advocated, not all children seem to have achieved appropriate educational standards. For example, in Study 1 of Solity et al (2000), the bottom 25% of children who had received the ERR scored 7.84 (SD 4.12) on the post-intervention British Ability Scales. This score coincides with the 23rd centile for the norms of the test. Given that the ERR figures show a relatively normal distribution, we would expect some 5 to 10% of children to still be scoring below the 10th centile for word reading following intervention. Such children may need alternative procedures to improve learning. In order to provide effective education for all children, more individualised assessment and learning procedures may be a requirement.

ERR is obviously a potentially useful procedure. It is unfortunate that programmes are described only in terms of broad instructional principles, with general frameworks of instruction being presented rather than information on specific methods. Examples of materials and programmes would be illuminating. A full assessment of the procedure requires more details of the methods used to allow contrasts to be made with alternatives. Similar claims have been made for the general success of other remedial or national literacy programmes (for example, Branwhite, 1983; Clay, 1985; McGuinness, 1998; Sainsbury et al, 1998). A potential barrier to rational debate is the tone of some observations and conclusions that seem politically aggressive rather than empirically balanced. There is a need for intelligent and unbiased research to investigate differences between such methods. Careful and rigorous investigation is hindered by apparent self-advertisement; for example, as that found in McGuinness (1998). Attempts to bring rigour to education are vital, but some reports seem a victory of propaganda over a reasoned consideration of possible principles, explanations and evidence. Brooks and Weeks (1999) have provided evidence that simple individualisation of children's learning of spellings was related to a doubling in rates of learning. These findings do not lead the authors to conclude that the National Literacy Strategy, Early Reading Research, Direct Instruction, phonological training, Reading Recovery, and Janet and John are all worthless! Such generalisations would be appropriate only if the research directly compared these different procedures. Similarly, each procedure may be effective in some educational contexts or with certain children. All may include elements that provide the basis of success for a programme.

Educational psychology has been prone to mood swings between cognitive and behaviourist approaches at a rate of approximately one per decade. The current literature suggests some resurgence in narrow behaviourist views of children's education and development. For example, in a recent paper Thomas (2002) encourages focussing solely on reading skills to the neglect of research evidence that phonological training has been found to

be effective in increasing reading skills (see evidence presented above). Reed (1999) extends Cameron's (1997) views into a comparison of functionalist and structuralist approaches. Grecian through to European philosophy clarifies man's intrinsic need, and effectiveness, in understanding the functioning of systems, rather than merely antecedents and consequences; consider the work of Plato, Descartes, Kant and Sartre. There would appear to be no need for these approaches to be exclusive; indeed, they are complementary. It might be argued that functionalist evidence offers the best confirmation of the causal explanations of structuralism. Dyslexia would not be seen as a mere result of an IQ and reading discrepancy, but as an increasingly clearly perceived cognitive process that can clarify the discomfort suffered by a large minority and offer some solutions to easier progress. Indeed, it might be argued that phonological models of literacy development and dyslexia have led to advances in literacy levels in young children (see, evidence in previous section of this chapter). IQ and reading comparisons are merely a simple sample from a person's cognitive profile. We would seek to extend our knowledge of cognitive and literacy development, rather than ignore such advances within educational and psychological knowledge. As Reed notes (page 54), "Difficulty ... is no excuse for such a lack of clarity in the underlying philosophical and scientific approach to a problem". Counter to (page 51) "the documentation of the functional relationships between events is both the goal and the sign of a mature science", Harre (2000) notes that psychology requires molecular, organic and personal systems. The relationship between events can only be partly investigated through any approach that wholeheartedly grasps just one system. A full understanding of literacy will require behavioural, cognitive and personality issues to be encompassed.

Approaches that concern themselves with behavioural outcomes (eg, scores on a reading test) and factors external to the child (eg, using a particular reading scheme) will gain even greater power if they incorporate within-child variables and a full acknowledgement, investigation and understanding of individual means to successful learning. We see no reason why Skinner, Bartlett and Bruner cannot coexist; indeed, polarisation in thought will guarantee a blinkered perception of development. Such a collaboration of approaches is clearly possible, particularly given that the differing views are not as divergent as sometimes presented. Those advocating assessment of individual children would, in the main, agree that improvements in teacher training and an understanding of the learning process would improve educational practice within schools; this is one of the important themes emanating from the work of Solity and colleagues (Solity, 2000; Solity et al, 2000). Such factors external to the individual child need to be considered when identifying ways to improve learning. However, those arguing for improvements in teaching would often still recognise the need to treat children differently and, therefore, some criteria for differential treatment are required. The position argued in this paper is that cognitive profiling will inform the basis for children's learning methods and appropriate support, rather than solely relying on the assessment of success or failure in literacy learning derived from a focus on teaching within a common curriculum. This argument does not preclude the need for improved teacher awareness and teaching skills; rather it argues against simply refocusing the centre of attention from the child to the teacher, and for fully taking account of both perspectives. Further research should provide evidence for or against the combining of these theoretical and practical viewpoints.

CONCLUSION

When educational psychologists assess an individual, each case needs to be considered at an individual level. A combination of individual profile in addition to a consideration of the curriculum that the individual is experiencing will better inform the most appropriate processes to support learning. It is not sufficient to provide one rule for all that simply states that poor literacy levels will be responded to by a single method or to just monitor and adapt the same learning procedures. A diversity of approaches may be necessary to support the diversity of skills and weaknesses shown by individual learners. Similarly, failure in literacy learning need not be solely due to factors within the child. Wider curriculum factors need to be taken into account, including the ability of the teachers to present the curriculum. Research may identify the most effective method for starting all children on the road to full literacy; however, it is unlikely to be the panacea for all throughout their education. Therefore, all factors (internal and external to the individual) that help identify the most effective method need to be considered. Such work may indicate that phonology, discrepancy, instruction and dyslexia, far from being opposing theoretical standpoints, are allies in the process of finding the most effective support for all individuals across education.

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Chapter 7

DYSLEXIA AND LOSS OF THE LEARNING DIALOGUE

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ABSTRACT

The Coping Inventory for Stressful Situations (CISS) (Endler & Parker, 1999) identifies three main behaviors in response to stress – trying hard to perform, blaming oneself or others for one’s failure, and avoiding exposure altogether.

It has been shown that, amongst pupils with dyslexia, these three behaviors are associated with different genders (Alexander-Passe, 2004a, 2006, in press) and different levels of self-esteem and depression (Alexander-Passe, 2004a, 2006) – in particular:

- Trying hard to perform – mainly males, gaining academic self-esteem from teacher approval
- Avoiding exposure – mainly females, shielding overall self-esteem
- Blaming – mainly females, losing personal self-esteem and showing depression.

As it happens, these three behaviors are opposites to the three that make up the simplest possible, basic learning dialogue (Zimmer, 2001; Zimmer & Chapman, 2004; Zimmer, 2008):

- Listening receptively rather than blaming, so as to invite thinking
- Showing comprehension rather than just trying hard, so as to invite listening in return, and
- Sharing one’s own thinking rather than avoiding exposure, so as to invite comprehension.

Evidence from the dyslexia literature shows that the three CISS behaviors are common amongst pupils with dyslexia, indicating that dyslexic pupils are often disengaged from the basic learning dialogue.

It was hypothesized that this non-engagement is due to teachers themselves not offering the basic learning dialogue.

Accordingly, the dyslexia literature was analyzed for reports of teachers' not offering receptive listening, or comprehension of pupils' thinking, or their own thinking in response.

Reports fitting this description were found in unfortunate abundance. In particular, teachers of dyslexic pupils were found often to impose:

- Rote teaching in place of their own thinking
- Judgmental discounting in place of receptive listening, and
- Humiliation for failure in place of comprehension.

It is concluded that learning by dyslexic pupils is at risk from teaching that does not support the basic learning dialogue.

An implication is that, for support of dyslexic pupils, care for the learning dialogue itself may be what matters most.

BACKGROUND

The Coping Inventory for Stressful Situations (CISS) was designed by Norman Endler and James Parker (1999) to investigate three main types of coping – Task-oriented, Emotion-oriented, and Avoidance-oriented. The behaviors involved can be summarized respectively as:

- Trying hard to perform
- Blaming oneself or others for one's failure, or
- Avoiding exposure altogether.

Alexander-Passe (Alexander-Passe, 2004a, 2006, in press) used the CISS to investigate the responses of teenagers with dyslexia to the stress that it causes. It was found that the three CISS behaviors were associated with different genders (Alexander-Passe, 2006, in press), and with different levels of self-esteem and depression (Alexander-Passe, 2004a, 2006):

- Trying hard to perform – mainly males, gaining academic self-esteem from teacher approval
- Avoiding exposure – mainly females, shielding overall self-esteem
- Blaming – mainly females, losing personal self-esteem and showing depression.

As it happens, these three behaviors are direct opposites to the three responses that make up the basic learning dialogue. This dialogue consists of three exchanges, as shown in Figure 1, where the circles represent Person A in the dialogue and the squares represent Person B. In principle, either person can initiate the dialogue.

It can be shown that this basic learning dialogue is the simplest possible learning dialogue (Zimmer & Chapman, 2004). Its three components are essentially the three behaviors that Carl Rogers identified as the core components of supportive communication (Rogers, 1962).

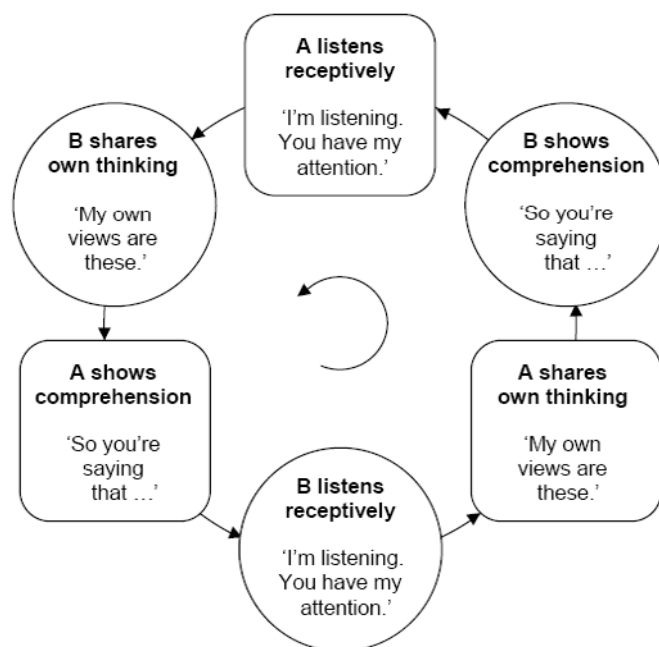


Figure 1. The basic learning dialogue between Persons A and B.

Their specific sequence results when the generic action-learning cycle is applied to interpersonal communication (Zimmer, 2001; 2008).

Starting at the top or the bottom, this diagram says that two people both need to listen receptively, show comprehension and share their own thinking, if a dialogue between them is to take place.

This is especially true for pupils, who have much less power to initiate such a dialogue than do their teachers. The diagram says that teachers really do need to listen receptively, show comprehension and share their own thinking, if their pupils are to be expected to do the same. In other words, pupils need to receive what their teachers should be providing.

What the teenaged dyslexic pupils in Alexander-Passe's study (2004a, 2006) were doing collectively, amounted to a direct opposite:

- Trying hard to perform – gaining academic self-esteem from teacher approval instead of showing real comprehension
- Avoiding exposure – shielding their self-esteem instead of sharing their thinking
- Blaming themselves or others – losing personal self-esteem and showing depression instead of receptively listening.

Although the last two of these opposites may be intuitively obvious, the first may be less so. It says that trying hard to perform – often encouraged by teachers – doesn't count as part of the learning dialogue. This is because actual comprehension makes hard trying unnecessary – task performance follows easily from comprehension, and does not involve the frustrations that continued hard trying can produce.

This may be easier to see if the entire reciprocal dynamic of the learning dialogue is included. The teenaged dyslexic pupils in the Alexander-Passe studies were found to be:

- Trying hard to perform, gaining academic self-esteem from teacher approval – instead of showing comprehension, which they can only do if they feel informed by their teachers' thinking
- Avoiding exposure, shielding their self-esteem – instead of sharing their own thinking, which they can only do if they feel receptively listened to by their teachers
- Blaming themselves or others, losing personal self-esteem and showing depression – instead of receptively listening, which they can only do if they feel accurately comprehended by their teachers.

In other words, these dyslexic pupils collectively were trying, avoiding and blaming instead of engaging in the basic learning dialogue – which they can engage in only if they feel offered it by their teachers.

This result raised three questions:

- Is loss of the basic learning dialogue common for pupils with dyslexia?
- If so, are they being given something else instead?
- If so, how can the basic learning dialogue be restored?

This chapter offers answers to these three questions in turn.

LITERATURE REVIEW – IS LOSS OF THE BASIC LEARNING DIALOGUE COMMON FOR PUPILS WITH DYSLEXIA?

The literature was examined for evidence of the three CISS behaviors amongst dyslexic pupils – trying, avoiding and blaming – which were identified as opposites to the basic learning dialogue. Considerable evidence was found.

Trying Hard Instead of Showing Comprehension

The literature shows considerable evidence of dyslexic pupils trying hard to perform – gaining self-esteem from teacher approval – instead of showing comprehension. It can lead to frustration.

Trying Hard

Some pupils 'buckle down' and work very hard to overcome their problems, especially by focusing their energies on subjects in which they can excel. This earns them teacher approval (Riddick, 1996).

There is a downside, however. Pupils who use hard trying to overcome their difficulties can sometimes do well enough to look as though they don't need support in class. Their apparent success then works against them, since they can spend all night doing work that their peers need only a few hours to complete. Indeed, as found in an interview study by Alexander-Passe (2004a), they are likely to have had private tutoring for their dyslexia since primary school.

Becoming Frustrated

There is a further downside. It is common for this group to be highly intelligent, but to achieve only to the mid-level of their peers. This may look sufficient for their teachers, but they themselves can feel that they are not reaching their potential and can become frustrated in class (Alexander-Passe, in press)

Indeed, the children's frustration can become enormous. Thomson (1996) notes that it is important for teachers to recognize the frustration that dyslexics feel in classrooms, because of their difficulties in expressing their ideas in written form, and because of their having to work considerably harder than their peers to attain the same achievement level.

Ryan (1994) has commented that no one really knows how hard a dyslexic child is trying, and that each year their peers surpass them in reading skills, their frustration increases.

Avoiding Exposure Instead of Sharing Their Thinking

The literature also shows considerable evidence of dyslexic pupils avoiding exposure – shielding their self-esteem – instead of sharing their thinking.

As shown below, when trying doesn't work, pupils ask for help. Some bypass trying and simply start with asking for help. Either way, they often are ignored. Some then try attention-seeking, but get reprimanded. Then they start to avoid specific tasks. Then they avoid school altogether.

Asking for Help but Being Ignored

Typically, dyslexic pupils are not identified as having dyslexia, so they don't receive the help that they need when they need it most (Riddick, 1996). Local educational authorities usually require a reading deficit of at least two years before assessment is even considered. OFSTED (1999) found that deficits of more than four years were not uncommon.

This frustrating delay can affect the children's relationships with their parents, their siblings and their peers (Riddick, 1996). Importantly, it can create disaffection towards learning, teachers and school.

Seeking Attention but Being Reprimanded

Nevertheless, most children with dyslexia don't give up. As a result of their parents' beliefs, they feel that they should go to school to learn (Edwards, 1994). Experience suggests that they want very much to learn, and that they will stay at school even in the face of adversity from teachers (Alexander-Passe, in press; Riddick, 1996; Edwards, 1994).

So when children with dyslexia can't get the help that they seek, they typically resort to seeking attention (Fontana, 1995). If attention isn't forthcoming from their teachers, then they seek it from their peers by clowning around in class (Edwards, 1994).

According to Fontana (1995), such attention-seeking is:

not a deliberate attempt to create problems for teachers ... but a conditioned response associated with the need for attention ... and is recognized as one of the major causes of classroom problems (Fontana, 1995, p. 358).

Molnar and Lindquist (1989) offer a complementary interpretation. They found that pupils also might disrupt a class because they interpret the class work as threatening and use attention-seeking to protect their self-esteem. This is an early form of avoidance.

Avoiding Specific Tasks

When attention-seeking doesn't work, pupils often turn to avoidance. Indeed, some start there. These strategies deflect attention from low academic ability and under-performance. Ryan (1994) notes that these strategies are more related to anxiety and confusion than to apathy. They protect self-esteem.

Typically, dyslexic pupils start by avoiding specific words. For example, Pollock and Waller (1994) found that pupils with dyslexia were perceived as immature in their choice of words and mode of expression, since they preferred to stick to words that they knew how to spell. If they spelt a more complicated word wrong, they would be criticized as if careless. Being conscientious, they preferred to look immature (Alexander-Passe, 2004a, 2004b, in press).

Pupils with dyslexia also tend to write less. One parent noted, 'Mandy writes a lot less than other children, because she takes twice as long to write it' (Mosely, 1989).

Some pupils progress to avoiding starting work in the first place (Riddick, 1996).

Out of the 45 pupils studied by Riddick, avoidance in one or another of these three forms featured in the coping strategies of 35 of them (Riddick, 1996).

Avoiding School Altogether

When avoiding specific tasks doesn't work, some pupils avoid school altogether. Dyslexia and truancy have been linked by Klein (1998), by Svensson, Jacobson & Lundberg (2001) and by Salford City Council (2004). Salford notes:

There are many reasons why young people play truant. Sometimes they are having difficulties with their school work and are feeling discouraged. In some cases a young person may have a learning difficulty (e.g. dyslexia) that has not been recognized.

The Audit Commission (2002a) were very concerned about the significant over-representation of these pupils in national non-attendance and exclusion statistics, noting the Social Exclusion Unit's (1999) findings of clear links between poor attendance and under-achievement. Looking for the cause, Gardner (1994) found that pupils with dyslexia are prone to withdraw from situations in which they perceive that they cannot cope (e.g. spelling tests). This withdrawal can be from specific lessons or for whole days.

As mentioned above, though, pupils with dyslexia often really want to be at school (Edwards, 1994). Either they want to be there to learn for themselves, or they feel that they ought to be there for others (social conscience). Then they find the frustration intolerable. From this conflict situation, they find ways out that involve personal cost.

Some dyslexic pupils deliberately create painful situations that get them out of school. They feign illness, or acquire deliberate injuries (Edwards, 1994). For example, one 12-year-old used to get into fights with larger kids or other dyslexic kids to get off school. The injuries were for mutual avoidance reasons, not anger, and usually meant two to three days off school.

Some especially conscientious pupils with dyslexia, who are not willing to truant, develop symptoms which then keep them out of school. 'I used to pretend I was sick, make

myself puke, and say I don't wanna go today', one dyslexic teenager commented (Edwards, 1994, p. 110).

Sometimes the symptoms are psychosomatic. One teenager developed a pain in his right leg requiring crutches. To him it felt like a rare disease. The hospital doctor concluded that he was dyslexic but intelligent, was therefore frustrated, and that the frustration was expressed as pain in the right thigh, which occurred about once every six months and could last 10 days at a time (p. 39).

Although all this avoiding shields pupils' self-esteem, it represents a sad loss of learners who begin with enthusiasm and end by turning away.

Blaming Instead of Listening Receptively

The literature shows that many pupils who are unable to shield their self-esteem through avoiding, lose their self-esteem and sink into helpless blaming. Some start there. Then they go one of two ways. If they blame themselves, they turn their unhappiness inward, and withdraw and hide. If they blame others, they project their unhappiness outward, and become aggressive and turn to crime.

Blaming of Self – Withdrawing and Hiding

In Butkowsky and Willows' study (1980), average to good readers attributed their success to their ability, but poor readers tended to blame themselves by attributing failure to their own incompetence (a low sense of approval of themselves), while attributing success to external factors such as luck.

In Butkowsky and Willows' study (1980), those who blamed themselves for their failure then gave up.

Nearly half of Riddick's sample (1996, p. 147) openly avoided telling their friends and other pupils that they had dyslexia. They had a low sense of approval from peers. Reasons for not telling included:

'I don't want to tell anyone, because I think they'll tell everyone else, and then everybody might tease me.... Some people I do tell, some I don't. Most of them would just make fun of me... Only my best friend knows.'

Blaming of Others – Becoming Aggressive and Turning to Crime

Morgan and Klein (2001, p. 61) found that lack of understanding at school and at home (a low sense of approval from parents), and bullying by teachers and peers, can lead to violent reactions. One dyslexic tutor recalled her own experiences at school (as a dyslexic) – she actually stabbed a teacher's hand with the sharp end of a compass, because 'she called me stupid once too often'.

Van der Stoel (1990) likewise found links among dyslexics, between aggression in class and being mocked in class for having problems when reading out loud. Critchley (1968), Jorm, Share, Maclean & Matthews (1986), Rosenthal (1973), Rutter, Tizard & Whitmore (1970), and Pianta & Caldwell (1990) all found correlations between acted-out antisocial aggression and problems in reading. According to Van der Stoel (1990) one dyslexic commented about school:

'I was forever being told off and was the laughing stock of the class. Turns at reading aloud were a disaster. ... I'm quite a spitfire and my self-control went completely.'

Edwards (1994, p. 139) noticed in a sample of severe dyslexics that they all exhibited behavioral manifestations from their experiences at school. Most in fact were hostile and disruptive towards teachers, and showed aggression and cheekiness as early as primary school. Examples of these acts ranged from 'sabotaging the ladies loo as revenge on teachers and hitting other pupils', through 'destruction of school property' to 'fights with other pupils'.

Edwards also found that this behavior was often linked to dislike of the teacher's methods, boredom with the subject being taught, inability to do the class task required and conflict with the class teacher.

Such aggression in turn can lead to delinquency and crime (Morgan, 1996). Alm & Andersson (1995), Antonoff (2000), Kirk & Reid (2001) and Morgan (1996) all have identified very high percentages of dyslexic adults and young people among offenders. These studies from England, the USA and Sweden suggest that 30%–50% of the prison population in their countries are dyslexic. By contrast with the general population, in England the British Dyslexia Association (2006) estimates that between 4% and 10% of the general population are dyslexic. In America the International Dyslexia Association (2000) estimates 15%.

There are suggestions that not only recognized dyslexics can feel devalued at school, but also unrecognized dyslexics who are receiving insufficient or inappropriate support, and that this is a major reason why they turn to deviant behavior. Peer & Reid (2001, p. 5) suggest that 'frustration leads very often to antisocial or deviant behavior' amongst dyslexics, especially amongst those with low self-esteem.

Morgan's (1996) study of delinquent/criminal dyslexics found that, when pupils with dyslexia fail to keep up at school, their self-esteem drops as they begin to question their academic abilities, and they develop inferiority complexes. Nearly all of Morgan's dyslexic (criminal) sample felt that they were not given appropriate remedial support at school. By the time they reached their teens they voted with their feet, played truant and mixed with delinquents. Similar findings concerning dyslexics and crime have been found by Devlin (1995). This would suggest that many young dyslexics could be prevented from drifting into crime by better support at school.

The Dyspel Pilot Project (Klein, 1998), which identified dyslexia among both young and old adult offenders, found that only 5% had been diagnosed as dyslexic at school. Many of the dyslexics were serious truants or had left school as early as 11 or 12 years old. Others had been excluded or sent to special schools for behavioral problems, without their specific learning difficulties being addressed. The Project found dyslexic offenders speaking of distressing memories of school, including frequent public humiliation in front of their peers, and including their violent outbursts in response to frustration at not learning and at being mocked or humiliated.

A study for the Home Office (Davis, Caddick, Lyon, Doling, Hasler, Webster, Reed & Ford, 1997) on offenders under probation supervision found a common life story amongst those seeking literacy provision (N=12 male offenders). Most came from families where there was little encouragement to develop literacy, and in general there was poor quality family support. All left school before exams to avoid certain failure, 'although in reality they had ceased participating much earlier' (p. 28).

All this helpless blaming of self or others represents a depressing loss of personal self-esteem – the kind due to approval from self, parents and peers – amongst pupils who, if their disability had been recognized, might have done much better.

SUMMARY OF LITERATURE REVIEW

This review of the literature has shown that pupils with dyslexia commonly display loss of the basic learning dialogue, and display instead the CISS stress-coping behaviors of trying hard, avoiding exposure and blaming.

In particular, they:

- Try hard to perform tasks – gaining academic self-esteem from teacher approval instead of showing real comprehension, so eventually become frustrated
- Avoid exposure – shielding their self-esteem instead of sharing their thinking, so effectively drop out
- Blame themselves or others – losing personal self-esteem and showing depression instead of receptively listening, so withdraw or turn to crime.

So the question arises, Why is this happening? What can explain this common loss of the basic learning dialogue? Are dyslexic pupils being given something else instead?

QUESTION – IS IT COMMON FOR DYSLEXIC PUPILS TO BE GIVEN SOMETHING OTHER THAN THE BASIC LEARNING DIALOGUE?

An answer to the question of why the basic learning dialogue is being lost, can be sought by considering who initiates it. Although the dialogue is reciprocal, pupils have much less power to initiate it than do teachers.

When teachers initiate the basic learning dialogue with sharing of their own thinking (in order to set the topic), the dialogue looks like this:

- sharing of their own thinking, to invite pupils' comprehension
 - listening receptively, to invite pupils' sharing of *their* own thinking
 - showing comprehension of pupil's thinking, in order to invite pupils' receptive listening in return.
-
- (more sharing of teachers' own thinking)

So the question becomes, Do pupils with dyslexia normally receive these three invitations to participate in the learning dialogue?

METHOD – LITERATURE ANALYSIS

Analysis of the literature, as shown below, reveals that pupils with dyslexia often are given the very opposite of the basic learning dialogue. They are given:

- rote instruction, instead of the sharing of thinking that would invite their comprehension
- judgmental discounting, instead of the receptive listening that would invite their sharing of their own thinking
- humiliation for failure, instead of the comprehension of their thinking that would invite their receptive listening.

Rote Instruction Instead of Teachers Sharing Their Thinking

Teachers often shunt dyslexic pupils into classes of mainly lower-ability non-dyslexics (Ireson, Hallam, Mortimore, Hack, Clark & Plewis, 1999). This in turn can affect the opportunities that they have within classrooms (Ireson *et al.*, 1999; Boaler, Dylan & Brown, 2000).

Literacy Difficulties Confused with Low Intellectual Ability

According to OFSTED (2003), dyslexics are streamed into the lowest-ability classroom groups because of their literacy difficulties, not their intellectual abilities. There, they normally are taught with more repetition, less discussion, and more practical activities (Ireson *et al.*, 1999).

Fawcett (1995) has noted that such rote teaching is something that dyslexics find difficult to cope with. Riddick (1996, p. 44) has commented that:

... if teachers have little understanding of the learning problems involved in dyslexia, it will make it difficult for them to set appropriate goals.

Indeed, OFSTED (2003) has reported that:

... across the lessons seen in mainstream and special schools, too much learning was not as effective as it ought to be, mainly because pupils worked in ways that did not stimulate or challenge them, they were not given sufficient responsibility or there was not enough emphasis on study skills in the context of the course.

Worse, these pupils get weaker teachers – thus locking in their disadvantage. For example, Boaler *et al.* (2000) found that schools had a tendency to allocate teachers with less experience and fewer qualifications to lower sets, and that the best teachers continued to be allocated to the ablest pupils – despite evidence that high quality teaching is more beneficial to lower attaining pupils. Likewise, OFSTED (2003) reported teaching that suffered from low expectations, lack of pace and insufficient challenge.

A common consequence of such streaming is the development of disaffection. Studies of ability-grouped classrooms (Boaler *et al.*, 2000, p. 5) have found that students in the lowest

ability groups 'felt disaffected on account of low expectations of their capability and limited opportunity for attainment'. For example:

'Sir treats us like babies, puts us down, makes us copy stuff off the board, puts all the answers like we don't know anything. And we're not going to learn from that, 'cause we've got to think for ourselves' (Year 6) (Boaler *et al.*, 2000, p. 6).

This is a tragedy, since dyslexics are cognitively better served by sharing of thinking by both teachers and other pupils, especially in oral discussions (Riddick, 1996). Since dyslexics commonly excel orally, removing intelligent discussion from the classroom limits their ability to show their intelligence.

For higher IQ dyslexics, this means that they are not being stretched academically, and so are not being given the 'access to the whole curriculum' that is their legal due.

Access to the Wider Curriculum Denied

According to the Code of Practice (Department for Education and Employment, 2001, p. 13):

Children with special educational needs should be offered full access to a broad, balanced and relevant education.

Yet, according to the Audit Commission (2002a, p. 26):

Some children with special educational needs are regularly excluded from aspects of the curriculum, usually as a result of judgments made by teaching staff about the suitability of certain lessons.

Likewise, Ireson *et al.* (1999, p. 10) report that:

In structured ability classes ... teachers reported a tendency for lower ability classes to have less access to the curriculum

Indeed, there is strong evidence that pupils with special educational needs miss national curriculum and non-national curriculum subjects, though not necessarily the same subjects consistently (Porter and Lacey, 1999). Exclusion from trips (63% of cases, as noted by teachers) also seems to be a common experience for pupils with learning difficulties (Porter and Lacey, 1999).

In short, pupils with dyslexia are routinely given rote instruction, instead of the sharing of thinking that would invite their comprehension.

Worse, being treated as if they are intellectually inadequate, leads to their being labeled as such and judgmentally discounted.

Judgmental Discounting Instead of Receptive Listening

Teachers make judgments about their pupils' abilities. In many cases (Hargreaves, Hester & Mellor, 1975; Cooper, 1993), such judgments are made on the basis of feedback from other teachers, and of opinions about the pupil's parents and siblings – e.g. troublesome older

siblings. A common basis for such judgments is denial of the existence of dyslexia, which leads to labeling of dyslexic pupils as inadequate, which in turn can lead to a self-fulfilling prophecy – as described below.

The Existence of Dyslexia Denied

A major form of judgmental discounting of pupils with dyslexia, starts with denial of the existence of dyslexia itself. Peer and Reid (2001) have noted that there is an issue about this, causing much difficulty for all concerned (dyslexic pupil, parent and teacher).

Some teachers are overtly unreceptive to requests for help from parents who are concerned about their child possibly having dyslexia. Dewhirst's (1995) study of teachers' perceptions of dyslexia, frequently revealed conversations like the one in Box 1.

Similarly, a head teacher responded to the question 'Is my child dyslexic?' with:

He's not dyslexic – he's just a silly little boy who won't concentrate for more than ten seconds. What he needs is a good kick up the backside! (Fawcett, 1995, p. 10).

Box 1. Excerpt from Dewhirst's study of teachers' perceptions of dyslexia

Interviewer:	Have you done any specialist training in the area of dyslexia?
Teacher:	Oh God, that! No, no I haven't (pulls a face). Why?
Interviewer:	Why did you pull a face when I asked you that?
Teacher:	Well...I mean, it's one of those things that has been conjured up by 'pushy parents' for their thick or lazy children; quite often both ...
Interviewer:	What exactly do you know about dyslexia?
Teacher:	Well, basically they can't read or write. It is supposed to be about problems in communication, isn't it? Generally it's children who are either too lazy or haven't got the brains and their parents can't hack it.
<i>Later on...</i>	
Interviewer:	If you haven't any training in the field of dyslexia, do you think really that you should be making judgements about it?
Teacher:	Yeah, it's a gut feeling you know, when you have been teaching as long as I have, you get to know which kids have problems and which kids are pulling the wool over your eyes.

A Self-Fulfilling Prophecy

Cohen & Manion (1995) note that it is natural for teachers to form different attitudes and expectations of their pupils in this way, but also that these expectations need to be assessed regularly. If not, then the pupil may get caught in a 'vicious circle of failure' (p. 269), i.e. a self-fulfilling prophecy. Good & Brophy (1974) have spelt out this self-fulfilling prophecy, and how it affects the interactions of teachers and pupils in the classroom, as in Box 2.

The result is that pupils with dyslexia aren't listened to receptively, because the teacher doesn't expect to hear intelligent thinking.

It might be hoped that dynamics like those above would be a thing of the past, but the evidence suggests otherwise. In a respected teacher-training manual, Fontana (1995) suggests that dyslexic pupils starting school may find that they receive less teacher approval and praise than other pupils. The Audit Commission (2002a) noted unwelcoming attitudes of some

Box 2. Good & Brophy's self-fulfilling prophecy

The teacher expects specific behaviour from particular children.

Because of his different expectations, he behaves differently towards these different children.

The teacher's treatment tells each child what behaviours and achievements the teacher expects, and this in turn affects the child's self-concept, achievement motivation and level of aspiration.

If the teacher's treatment is consistent over time, and if the child does not actively resist it or change in some way, it will tend to shape the child's achievements and behaviour.

With time, the child's achievements and behaviour will conform more and more closely to what the teacher originally expected.

schools towards pupils with special educational needs – which includes dyslexic pupils – and their exclusion from aspects of school life. Outright hostility was encountered by parents in some schools (even in the school's special educational needs department), to getting their child assessed in order to obtain specialist tuition (Audit Commission, 2002b).

Riddick (1996) suggests that the teachers who are most hostile or critical of the concept of dyslexia are the ones who are least likely to read about it or get training about it. In other words, they don't know that they don't know. Indeed, many think that dyslexia is just a figment of the imagination of ambitious, unrealistic middle-class parents.

It might be hoped, with dyslexia now formally recognized in the special educational needs Code of Practice (DfEE, 2001) and a mandatory element of teacher training, that more of the teaching profession will gain the knowledge necessary in order to assist parents and their children in getting specialist assistance when and where needed. However, a study by one of the authors indicates that this is happening only slowly, if at all (Alexander-Passe, 2004b).

In other words, pupils with dyslexia are routinely given judgmental discounting, instead of the receptive listening that would invite their sharing of their thinking.

Worse, many are not just discounted, but are actually humiliated.

Humiliation for Failure Instead of Comprehension of Pupils' Thinking

According to Edwards (1994) and Eade (1999), evidence suggests that pupils with dyslexia at mainstream schools often experience humiliation and censure from teachers and peers. This can shut down their receptiveness not only toward their teachers, but toward school entirely.

Humiliation from Teachers

Riddick (1996) notes that pupils with dyslexia – and their mothers – have been ignored in schools, shown insensitivity and non-understanding, branded as useless and generally humiliated.

She notes that there is particular concern amongst dyslexic pupils, about public indicators of their difficulties, e.g. finishing last or being required to read aloud. In particular, cases are numerous of pupils with dyslexia being given reading books set by their reading age rather than by their actual chronological age (Edwards, 1994). This causes not only great embarrassment to pupils in front of their peers, but also denigrates their maturity. Examples include giving a ten year old pupil a ‘Thomas the Tank Engine’ book to read out loud in class (Osmond, 1994, p. 21).

Censure from Teachers

A worse form of humiliation is actual censuring by teachers, which involves attributing negligence to pupils who are doing their best. One pupil with dyslexia said:

‘My history teacher is horrible, I got spellings wrong and I now have to write them out ten times, 200 words – and I am dyslexic! I spoke to Mrs [SENCO] and she is trying to sort this out’ (Audit Commission, 2002a, p. 38).

Worse still is censuring that involves attributing not just negligence but malice to pupils who are doing their best. As one parent put it:

‘Sometimes they say he is naughty and send him home, but he is not – there is a lack of awareness’ (Audit Commission, 2002a, p. 38).

Such negative attributions typically are followed by punishment. The teacher or school punishes the pupil for what the teacher or school has attributed to the pupil – in total ignorance of what is actually going on in the pupil.

A common punishment is exclusion – not just for a day, but for good. According to the Audit Commission (2002a, p. 28):

Local Educational Authorities special educational needs [pupils] (including those without statements) account for the vast majority of permanent exclusions (87% from primary and 60% from secondary schools).

Edwards (1994) found that the negative experiences of school for dyslexic teenagers consist not only of neglect or inadequate help from teachers and unfair treatment or other discrimination, but also humiliation, persecution, and even violence. Dockrell, Peacey & Lunt (2002, p. 33) have noted that this happens especially for pupils without statutory statements.

The reactions of pupils to such negative experiences have been – not surprisingly – lack of confidence, self-doubt / self-denigration and sensitivity to criticism, behavioral problems, truancy / school refusal and competitiveness disorders (Edwards, 1994).

Humiliation from Peers

As Edwards (1994) found, if pupils with dyslexia are treated as different, inferior, stupid, or less valuable by teachers, then the rest of the class will pick up on it in the playground. As

Osmond (1994, p. 21) noted regarding the boy who was given a 'Thomas the Tank Engine' book to read out loud in class:

Henceforth he was called Thomas by the other pupils, who made 'choo choo' sounds whenever they saw him in the playground.

In the playground, peers will also belittle and humiliate dyslexics by excluding them from social activities, since they are perceived as 'broken machines' (Hales, 1995) – a perception that is reinforced by their attendance in lower stream classrooms.

Riddick (1996, p. 149) found that half of her dyslexic school-aged study sample had been teased specifically about school difficulties related to dyslexia. One commented:

'She (member of her peer group) kept saying I was thick because I was always last on our table (to copy things down).'

Another reported:

'They said I was dumb and a nerd because, like, I couldn't spell things.'

The children then submerge into themselves, never to be seen again – basically outcast from their peer groups.

All of this happens because dyslexic pupils too often are seen as inherently lazy or malicious, rather than as showing evidence of stress. As one head teacher of an emotional and behavioral disabilities school has said (Dockrell *et al.*, 2002, p. 34):

'I find it devastating that in a special school, an emotional and behavioral disabilities (EBD) special school, we get children coming to us because of behaviors they have demonstrated in mainstream school and nobody has tried to identify the cause of that behavior.'

In short, pupils with dyslexia routinely receive humiliation, instead of the comprehension that would invite their receptive listening.

RESULT – CORROBORATION OF THE HYPOTHESIS

The analysis of the literature has shown that a major reason why pupils with dyslexia engage in opposites to the learning dialogue, is that they are not being invited into it. They routinely receive a complete opposite:

- rote instruction, instead of the sharing of thinking that would invite their comprehension
- judgmental discounting, instead of the receptive listening that would invite their sharing of their own thinking, and
- humiliation for failure, instead of the comprehension of their thinking that would invite their receptive listening in return.

In short, if teachers assume that pupils who can't read or write therefore can't learn, they then give the pupils rote instruction in place of conceptual thinking. Pupils respond by trying hard to perform instead of showing comprehension – and often fail. If teachers then judgmentally discount the pupils as 'thick' or the like, the pupils begin to avoid exposure instead of sharing their own thinking. If teachers then humiliate or censure the pupils, the pupils begin to blame themselves for their failure – or else blame and attack someone else and get themselves excluded.

CONCLUSION – FOR DYSLEXIC PUPILS THE BASIC LEARNING DIALOGUE IS ITSELF AT RISK

This result raises the possibility that the difficulties experienced in school by pupils with dyslexia, are due mainly to loss of the learning dialogue itself – and that for support of these pupils, safeguarding the learning dialogue itself may be what matters most.

IMPLICATIONS – THREE KINDS OF TEACHING CAN PROTECT THE BASIC LEARNING DIALOGUE

The structure of the basic learning dialogue shows what is needed in order to restore it – three key kinds of teaching. Pupils need:

- to be shown thinking – not rote-taught, if they are to show comprehension – not just try hard
- to be shown receptiveness – not judgmentally discounted, if they are to share their own thinking – not simply avoid exposure
- to be shown comprehension of their thinking – not humiliated for failure, if they are to listen receptively in return – not sink into blame.

Why don't all teachers do this? The answer appears to lie in false assumptions about pupils with dyslexia – false assumptions summarized above. If these false assumptions can be addressed, progress may be possible.

FURTHER RESEARCH

The prevalence of the distressed behaviors of trying hard, avoiding exposure and blaming of self or others raises at least three questions for further research.

Q1. Can the Distressed Behaviors that a Dyslexic Pupil Displays Be Identified Soon Enough to Help?

A further paper (Alexander-Passe, in press) reports the design and testing of an experimental parental questionnaire, to help identify which pupils with dyslexia require which of the kinds of support identified above.

This questionnaire has been shown to be capable of identifying those pupils who are trying hard to perform, and those who are blaming themselves or others – but not those who are avoiding exposure, since parents often don't see that.

Further research is needed, to enable parents to identify whether their children are avoiding exposure.

Q2. Can a Way Be Found to Distinguish between Pupils Who Are Blaming Themselves and Pupils Who Are Blaming Others?

The distinction might seem easy to make, in that pupils blaming themselves might seem likely to sink into depression, whereas pupils blaming others might seem likely to erupt into aggression.

However, both forms of blaming are forms of helplessness, and the instruments used in the present study do not distinguish between them.

Further research is needed, to enable parents of children who are blaming, to identify reliably which form of blaming is in operation. Research based on the idea of 'locus of control' may provide a way forward (Alexander-Passe, 2008a, 2008b, in press).

Q3. What Happens If These Identifications Are Not Made?

Alexander-Passe (2004a, 2006, in press) takes a deep view of the situation that pupils with dyslexia currently face. In this qualitative study of teenagers 15-18 years old at school, they were asked whether they cope, how they cope, and what frustrates them about being a dyslexic at school. The situations that they report could be described as nightmares.

This suggests a need for further research, toward ways to enable pupils with dyslexia to take more control themselves of their learning experiences. Again, research based on the idea of 'locus of control' may provide a way forward (Alexander-Passe, 2008b, 2008c).

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Chapter 8

**COGNITIVE LOAD THEORY AND INSTRUCTIONAL
DESIGN: AN OUTLINE OF THE THEORY AND
REFLECTIONS ON A NEED FOR NEW DIRECTIONS TO
CATER FOR INDIVIDUAL DIFFERENCES
AND MOTIVATION**

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ABSTRACT

Cognitive load theory (hereafter CLT; see Sweller, 2006; Sweller, van Merriënboer & Paas, 1998; Sweller, 1994; 1988) has been used for nearly two decades to develop innovative learning formats in instructional design. It essentially draws upon some aspects of the information processing/schema theory approach to learning. The theory maintains that it is critical to take into account the limitations of our working memory if learning is to be efficient. Using hundreds of controlled empirical studies comparing conventional instructional formats to formats guided by CLT has generated positive results. These have been critically reviewed and generally accepted in the field of educational psychology.

The use of CLT designed formats suggest there is less mental effort for the learner, a reduced training time, higher performance on test scores and transfer to similar problems, and longer duration for retention of information. The theory presents one perspective of our cognitive architecture.

Among the many CLT instructional designs used, two concern individual differences and motivation. These are:

1. The prior knowledge of the learner (termed the expertise reversal effect - see Kalyuga, Ayres, Chandler & Sweller, 2003) and
2. Mental rehearsal (termed the imagination effect – see Ginns, 2005; Leahy & Sweller, 2007; 2005; 2004).

The expertise reversal effect is an interesting and counter intuitive effect explored by CLT where learners who have some prior knowledge of the instructional material may do worse, under certain conditions, rather than better than those learners with no prior knowledge.

The second condition, mental rehearsal, is a learning strategy that has been used for many years (e.g. Sackett, 1934; 1935). It has been known variously by other terminology including “anticipative reasoning” (Dunbar, 2000) and “self-explanation” (Renkl, 1997). Since 1998, CLT has researched this approach in a series of experiments and termed it the “imagination effect”. A number of motivational and cognitive issues have emerged that illustrate the conditions that make the strategy either viable or unproductive.

One of the relevant limitations of CLT is that the experiments do not cater *enough* for individual differences of the learner. Important factors within the field of individual differences such as motivation, learning styles or gender for example are not adequately taken into account.

This chapter will outline CLT, and then provide a summary of various experiments conducted within its theoretical framework. The experiments include exploration of the expertise reversal effect, the use of an imagination strategy (imagination effect) and unique work on CLT and motivation conducted by Pass, Tuovinen, van Merriënboer and Darabi (2005) and Pass and van Merriënboer (1993). From all of these studies, the chapter will identify some issues and limitations emerging concerning motivation and individual differences. New directions that may address these will be suggested.

INTRODUCTION

The hypotheses of the studies outlined are based on cognitive load theory (CLT) (Sweller, 2003; 1988, 1994; Sweller & Chandler, 1994; Sweller, van Merriënboer & Paas, 1998). The basic principles, which are based on an information processing approach⁵ to our cognitive architecture (Sweller, 2003) are outlined as follows.

Working Memory

Working memory⁶ (our consciousness) is very constrained in its capacity to hold new and unfamiliar information (e.g. Miller, 1956; Baddeley, 1992). An awareness of the constriction is a critical factor when designing instruction. This was highlighted in George Miller's (1956) influential paper *The magical number seven plus or minus two: Some limits on our capacity for processing information*. According to Miller's research, apparent memory storage was limited to 5 to 9 discrete pieces of information at a time or “elements”⁷. An element is a learning item in its simplest form (Chandler & Sweller, 1996; Sweller, 1994). This can be illustrated by the situation in which we are trying to memorize a new phone number because we may be unable write it down. We use mental rehearsal to repeat the

⁵ There are various types of memory system models (e.g. see Atkinson & Shiffrin, 1968; Leahy & Harris, 1989; Mayer, 1992)

⁶ Also called short term memory but now more commonly working memory, suggesting active processing rather than a passive storage area (Baddeley & Hitch, 1974).

⁷ Simon, H. A. suggested it was closer to five (Simon, 1975)

number and must actively do this continually or use some sort of mental strategy to remember it. If not, the information is irretrievably lost.

CLT also suggests that the degree of interrelatedness between each element to be learned determines how difficult it is to process the information in working memory. This is termed “element interactivity”. Some materials have no element relatedness or interaction and are easier to manipulate. For example learning the vocabulary of a foreign language is low in element interactivity. One can learn that the Italian word *mela* means *apple* in English separately from learning that *gato* means *cat*. A whole list of words can be learnt. Working memory load may become high but only because the number of words or elements exceed the threshold of around 5-9 elements. However a fewer number of elements or words can be processed if there is a high degree of element interaction and it is here that the exercise becomes more difficult. An example is learning the grammar of a language. A sentence structure is complex because it is high in element interactivity. A word must be learnt relative to the other words in the sentence. To illustrate, “I am eating an apple” cannot be expressed in a combination of “An apple eating am I”. The *meaning* may still exist because the vocabulary is identical yet it is nonetheless incorrect. For learners of English as a second language, or any language for that matter, the vocabulary needs to be acquired as well as the relation of each word to every other word with respect to syntax.

There are other examples of high element interaction. In mathematics, consider the equation $a + b = c$ solve for b . For this problem to be fully understood and completed, each pronumeral must be understood in relation to the other pronumerals. This is because the b in the equation is meaningless unless it understood in association with the a and the c .

These examples demonstrate the cognitive load placed upon a limited working memory when dealing with material that consists of elements that have a high level of interaction. It is the high level of relatedness, this element interactivity that distinguishes between material being easy or complex to process and understand.

So clearly the limitation in working memory capacity is a severe constraint. How can we function as human beings if we can only process 5 to 9 elements of information and fewer if they are high in element interaction? Fortunately, information held in working memory can be processed and stored in a more robust form. This is achieved by transference (encoding) into the final store, long-term memory. Long-term memory has capacities, features and capabilities that lessen the deficiencies of working memory.

Long-Term Memory and Schemas

Long-term memory is able to store an apparent limitless quantity of information (e.g. Chase & Simon, 1973; Newell & Simon, 1972). This information is in the form of created elements arranged in a hierarchy of structured schemas (e.g. Bartlett, 1932; Chi, Glaser & Rees, 1982; Larkin, McDermott, Simon & Simon, 1980). A schema is defined by Sweller (2006) as “a cognitive construct that allows many elements of information to be used as a single element”. A schema can be small, such as a full stop or large such as a procedure for driving a car. For example, schemas for the written word “jump” allow us to make sense of the intricate squiggles that form one element that also means “leap”, “hurdle” or “bound”.

Schemas can be processed in a controlled or an automatic fashion (e.g. Kotovsky, Hayes & Simon, 1985). A controlled processing example is a child learning to read. Each letter is

slowly deciphered to form words. It is a deliberate, slow and conscious action. In contrast, automatic processing is rapid. For instance, proficient readers of English can decipher the sentences on this page automatically rather than reading letter-by-letter or word-by-word. Automatic processing allows material to be processed unconsciously, in other words without working memory control. It is these automated schemas that are held in long-term memory which reduce the load on working memory. Therefore for effective learning to occur, the creation and automation of schemas is vital. This is because the small capacity of working memory is not as critical when using the automated schemas previously stored in long-term memory (Sweller, 2003).

The Relationship between Extraneous, Intrinsic and Germane Cognitive Load

One of the main theoretical foundations of CLT is the type of cognitive load and its source. Cognitive load on working memory can be manifested in various ways. One type is created by an instructional format or procedure and termed *extraneous cognitive load*. It is alterable and can be reduced by changing the instructions. For example, asking learners to imagine the steps to solving a problem as opposed to studying a worked example of the problem may adjust the extraneous cognitive load. As another example, a presentation on a physics concept may be given as a lecture, a video clip or an audio recording. Each of the presentations would have their own varying extraneous cognitive load. Thus, extraneous cognitive load is not considered to be set.

In contrast, intrinsic cognitive load is a function of the information that needs to be processed and is not alterable if understanding is to be retained. It is strictly dictated by the element interactivity of the task. The previous algebra example and the differences between learning a language's vocabulary and grammar illustrate the concept. As stated, intrinsic cognitive load is dependent on how many elements that, because they interact, must be processed simultaneously in working memory. To reiterate, CLT states that element interactivity generates how complex or difficult the material is to comprehend. Lastly, germane cognitive load is the load that helps schema construction and automation and so is applicable and beneficial to the learning task to be completed. For example, to thoughtfully consider how a is related to b and c in the algebra illustration would generate a germane cognitive load. These three loads have been generally accepted as critical factors producing the cognitive load effects.⁸

It is not uncommon that the design of instruction frequently overlooks the fact that working memory has constraints when it has to process novel or new information, in particular, complex information (higher element interactivity) generating a higher intrinsic cognitive load. Typical instructional designs are usually based on tradition, style or so-called common sense, and yet, the designs may be ineffective because they are not produced focused on the previously mentioned features of our human cognitive architecture. Altering the material by adjusting the extraneous cognitive load so that avoidable cognitive activities are

⁸ Recently researchers have been exploring in greater detail the exact role each load has, its type of measurement and to what extent it is significant in instructional design (see Ayres & Hanham, 2008). In particular, there is some debate about what precisely constitutes a germane versus intrinsic cognitive load (Moreno, 2006).

removed or reduced may improve learning and problem solving. This analysis also has resonance with experiments concerning aptitude-treatment interactions (ATI) (e.g. Coronach & Snow, 1977; Mayer, 1997; Mayer and Gallini, 1990; Mayer et al., 1975; Peterson, 1977; Snow et al., 1980; Snow and Lohman, 1984) in which the structure of material interacts with learner aptitude.

Over the last 20 years, numerous instructional formats have been designed in accordance with these principles of CLT. The formats produce “effects” and are mainly concerned with the learning of complex cognitive tasks. Controlled experiments using instructional formats such as worked examples, goal free problems, partially completed problems, integrated diagrams, dual modality, non-redundant information and mental rehearsal to name a few, have demonstrated their efficacy over conventional methods of instructional design. There is clear empirical evidence of higher performance, reduced training time and transfer of student learning to similar problems (see Paas, Renkl and Sweller 2003; Sweller 1988, 2006; Sweller & Chandler, 1994). The imagination and expertise reversal effects discussed in this chapter are based on CLT principles.

The Imagination Effect

One can use mental rehearsal, which includes visualization or imagining to aide learning. Various terminologies have been used to describe the same phenomena such as “symbolic rehearsal” (Sackett, 1934, 1935), “imaginary practice” (Perry, 1939), “anticipative reasoning” (Dunbar, 2000) and “self-explanation” (Renkl, 1997). For many years mental rehearsal has been used in the area of sports instruction (e.g. Ericsson & Charness, 1994; Ericsson, Krampe & Tesch-Romer, 1993). Driskell, Copper and Moran in 1994 conducted a meta-analysis of “mental practice” sampling 35 studies. Their conclusion was that the strategy was efficient particularly if the learning task was of a cognitive rather than a physical nature.

Cognitive load theorists too have been exploring this for purely cognitive tasks rather than its general use in sports performance. They have also shown that if a learner has to “imagine” or mentally rehearse a procedure or concept, the learner will perform better than the learner instructed to “study” the same procedure or concept. Interestingly, this only occurred if learners had some level of experience in the domain (Cooper et al., 2001; Leahy et al., 2004; 2005). It was hypothesized that learners had to be able to maneuver the relevant material in working memory to imagine some procedures and concepts. The theorists term this the “imagination effect” (Cooper et al., 2001; Leahy & Sweller, 2004; 2005; Tindall-Ford & Sweller, 2006). Ginns (2005) completed a meta-analysis on the imagination effect in particular finding strong support for the strategy. It also needs to be noted that imagination is not restricted to visualization. Some researchers have extended the term to purely textual information as well. For example, Leahy and Sweller (2003; 2004; 2005) used instructional material from timetables and graphs which, involved learners visualizing textual as well as pictorial concepts and procedures.

An example of using an imagining strategy is where learners are told to thoroughly read parts of the instructional material for example, instructions on how to read a timetable. After reading, they are then told to turn away from the material or close their eyes and mentally rehearse the concept or procedure explained in the material. After this, they turn back to the material to check if they are correct thus receiving feedback and a more detailed rehearsal.

Imagining (or mentally rehearsing) impels learners to process the relevant schemas in working memory. This helps the schemas to become automated. To learn by imagining a concept or procedure assists in increasing information in long-term memory by utilizing prior knowledge that is already known about the concept or procedure and may result in the formation of superior schemas (Leahy & Sweller, 2005).

In comparison, learners involved in a “study” procedure, without eye closing or turning away may prematurely judge that they have learned and just read the material. They may ignore aspects of the information that require further rehearsal and only concentrate on information that requires no further learning.

The Expertise Reversal Effect

It has been demonstrated that CLT formats may not be as efficient (and the effects not generated) if a learner has attained some expertise in the area. An assessment of the prior knowledge of the learners has always been a critical factor before their selection into the expertise reversal studies (and other CLT studies in general). The advantages or effect appears to rely on novices and manifests itself in either of two ways.

In the first way, once the novice has gained some familiarity in the content area the advantage of the instructional format disappears and is not beneficial. As an example, the modality (audio-visual) effect is a cognitive load effect that occurs when audio text replacing written text in a diagram format of instruction is found to be more effective than written text. This effect has been demonstrated through many experiments (Leahy, Chandler & Sweller, 2003; Paivio, 1990; and see Penney, 1989 for a complete review) when used on novices. Kalyuga, Chandler and Sweller (1998, 2000) also found that this effect occurs with learners with little prior knowledge in the domain. However in their experiments they also established audio text becomes unnecessary with the improved expertise of the learner. What was occurring was that as the learner’s knowledge increased, this modality effect disappeared. Eventually, providing only the visual material was superior to an audio-visual format, or any presentation that incorporated the text. The text became redundant because of the increase in expertise of the learners.

In the second way, it may reverse, in other words, becomes detrimental. Leahy and Sweller (2005; 2003) found that other cognitive load effects, such as the imagination effect, can occur and then disappear (reverse) with improved expertise. In a 2005 study using two groups of experts and novices, experts were better at imagining material rather than studying indicating a study effect. In contrast, novices were better at studying the material and did very poorly at imagining. However, when the *same* two groups of learners were given the *same* material again and placed in either a study or imagining mode, the results showed a reversal of the effect. As the expert learner’s knowledge increased, the study effect disappeared and they became better at imagining.

For instructional designers, these results propose that as learners progress from inexperience to fluency in a domain, direction or guidance is provided more by schemas rather than instruction. Therefore, the direction made available by instruction (e.g. through the medium) should be incrementally lowered. Direction that is not required has a negative, not a neutral effect. This is the basis for the expertise reversal effect (Leahy & Sweller, 2005).

In summary of the expertise reversal effect, according to a review by Kalyuga (2008), over 2200 learners have participated in examined experimental studies. The results showed that the effect has been replicated utilizing a wide spectrum of instructional materials and participants. Expertise reversal has occurred for areas such as instructional guidance and sequencing of learning tasks, instructional hypertext and hypermedia, dynamic visual representations and pictorial and verbal representations. This has occurred either as a full reversal with significant differences between novices and experts alike. It has also occurred as a partial reversal with a significant interaction.

To summarize, the results of the many controlled experiments implementing the principles of CLT, including the imagination and expertise reversal effects are impressive. However there are some questions about the research in general that need addressing. One such concern is that most subjects are instructed and tested using a random selection process. This is deliberate, and the researchers do clearly state that they wish to demonstrate the effects are applicable to the general population. Dimensions assessed are generally performance, that is, the scores achieved on the test concerning the intervention. In some cases, time to completing the problems and transfer are also evaluated.

A dimension of individual differences to an extent is catered for in the expertise reversal effect experiments. CLT researchers do distinguish between learners on their prior knowledge before allocation to groups of either lower or higher expertise.

However, the process does not endeavor to examine variations within individual learners⁹. Issues such as motivation and individual differences are not generally taken into consideration. For example, when learners are instructed to use an imagining or studying strategy, there is no clear solution outlined in the experimental studies to assess whether indeed the learners are using the strategy. The learners may or may not be motivated to do so. These issues of motivation and individual differences will be now outlined in the following two sections.

The Role of Motivation and New Directions

As previously stated, CLT looks at redesigning instructional formats by matching them with our knowledge of cognitive processes. However, cognitive load can still be excessive by exceeding the limits of working memory. Learning that is effective requires mental effort and motivation. Negative consequences can be poorly processed material and little or no learning (Paas, Tuovinen, van Merriënboer & Darabi, 2005).

Paas et al. (2005) state that elements of motivation relating to learner effort incorporate “its perceived use, its value, and the importance of completing the activity” (e.g. Pintrich & Schrauben, 1992). Other elements include self-efficacy which is the perception a learner has about his/her ability to complete a task (Bandura, 1997). In addition, the difficulty of the task is a component that affects the expenditure of effort.

⁹ An obvious characteristic that may be taken into account for testing of the imagination effect is learning styles (Dunn, Dunn & Price, 1985). If the student is to imagine the instructional material, a test on whether he/she is a visual learner could be an additional variable. For example, how many learners who exhibit a visual learning preference prefer to use an imagining strategy? However CLT may justify this omission by stating that there has been extensive criticism of learning style theories (Desmedt & Valcke, 2004; Doyle & Rutherford, 1984) and its effectiveness for catering for individual learners and instructional material.

The characteristics of the learner influence the perceptions of the task as well. CLT explains this in terms of schemas. The schemas that have been formed from previous experiences e.g. prior knowledge will establish how the learner will assess a learning task in relation to the quantity of mental effort required for effective comprehension. Learner orientation according to goal theory is also pertinent¹⁰.

A guide for incorporating *motivation* into instructional design is Keller's (1999) ARCS (Attention Relevance Confidence Satisfaction) model which has had earlier broad research support (see Pass et al., 2005). Instructional designers can organize, test and evaluate learner's motivation and strategies by use of the model (Keller, 1983). One of the key elements of motivation and cognition in this model is practice variability. The sequence of tasks to practise can be varied and thus the learner's motivation may be enhanced. Learners create schemas when they are faced with diversity in presented problem situations. This is because the variations increase the chances that comparable and related features can be recognized and distinguished from those that are not relevant.

Other CLT researchers have also found that variability of practice increase schema construction and transfer but only if the total task cognitive load does not exceed working memory load (van Merriënboer, Schuurman, de Croock & Paas, 2002). In general, research has shown that the variability of practice is an effective technique to help learners exert more effort in their learning.

Paas and van Merriënboer (1994a) defined mental effort as really the quantity of cognitive resources devoted to learning. It could be argued that this description suggests that the amount of effort invested in a learning task is a valid indication of the learner's motivation or involvement in the task. Researchers can use mental effort measurements where it is used as an indicator of mental workload. This is where the mental effort is supposed to equal the total amount of controlled cognitive processing by the learner. Subjective measuring such as this is usually taken in many CLT experiments. Learners use a self-report method on a Likert scale indicating their *perceived difficulty* during the processing the learning task completed immediately after the task (these will be discussed later in this section). Alternative subjective techniques are verbal protocols ("think alouds") where the subject articulates their thinking processes whilst completing a learning task. Objective measurements can also be taken in the form of fMRI (Functional Magnetic Resonance Imaging). Other techniques are psychophysiological for example, eye tracking (van Gog, Brand-Gruwel, van Meeuwen, & Paas, 2008) or dual tasking. However, all of these procedures outlined can only be used as indicators and there is still no guarantee that the learner is purely focussed on the task. We may be able to look technologically at the brain, but not the mind.

Apart from this, it is obviously essential to investigate the circumstances that improve learner involvement. As such, the CLT researchers Paas et al. (2005) developed an innovative method to calculate and visualize motivation. This is an extension of the concept completed in the area by Paas and van Merriënboer (1993) and Tuovinen and Paas (2004). Mental effort

¹⁰Two goal structures related to motivation and learning that have received research attention are *mastery goal* orientated learners and *performance goal* orientated learners. Mastery goal orientated learners have an intrinsic interest in their learning and are attempting to understand, improve and achieve. They consider their performance in comparison to others as immaterial and mastery of the task as the goal. In contrast, performance orientated learners are concerned with their own ability and sense of self worth. Ability is displayed by outperforming others, surpassing norms or achieving with little effort. Public recognition is an important factor (Ames, 1992; Anderman, Austin & Johnson, 2003; Covington, 2000).

measurements are used. However, Paas et al. (2005) believe that a more reliable gauge is to take into consideration performance data from the task as well as the learner's invested mental effort. They consider this "optimal involvement". The basic premise is that performance and mental effort are positively related and a high performance (higher scores) with lower mental effort equals greater efficiency. Conversely, a low performance (lower scores) with higher mental effort equals a lower efficiency. The calculation uses the individual test scores and invested mental effort from subjective ratings (as on a Likert scale). These scores are standardized by conversion to *z scores*. This has been described as the *efficiency* of learning. This data can then be plotted on a Cartesian axis and visualized. It may be used to compare the relative effectiveness of various instructional conditions (Paas et al., 2005).

A CLT experiment from Tuovinen and Sweller (1999) was used by Paas et al. (2005) to illustrate this technique. Tuovinen and Sweller's study compared the differences between novice and more advanced learners using a worked example and free exploration format. The instructional material task for learners was the analysis of databases. This is content that is complex and thus high in intrinsic cognitive load. The overall results showed that learners with little prior knowledge experienced difficulty under the exploration condition and scored below that of the learners with prior knowledge. Low prior knowledge learners benefited more from worked examples whereas the higher prior knowledge learners did not¹¹. The data set of this experiment in the form of mental effort ratings and test scores was then examined using the Paas et al. procedure of conversion to *z scores*. The exploration practice groups and prior knowledge groups showed the highest involvement. The higher prior knowledge group also showed more involvement. CLT researchers explain this as "cognitive efficiency". An alternative explanation from a motivation perspective may be that more advanced learners may not be as stimulated to learn material they already know or benefit from highly structured instructions such as worked examples.

Notwithstanding the perspective put forth, the Paas et al. procedure did align with the results from Tuovinen and Sweller (1999). A number of CLT experiments (some on the expertise reversal effect) using this efficiency technique have been completed using sampled data sets (e.g. Kalyuga, Chandler & Sweller, 2001; Paas & van Merriënboer, 1993, 1994a; van Gerven, Paas, van Merriënboer, Hendriks & Schmidt, 2003).

However, there are some questions about the technique that are also raised by the researchers themselves. The calculation assumes there is a straightforward linear relationship between mental effort and performance scores. Another criticism of the method is that *involvement* is described as equal to the quantity of mental effort the learner puts into the task. However the calculation used to adding this quantity of mental effort and task performance incorporates an additional aspect; this is, that given the identical quantity of mental effort, involvement relies on performance (Paas et al., 2005).

A further concern of the method is that there are other aspects that affect the quantity of mental effort put forth by a learner. One of these aspects is the perceived task difficulty outlined previously in this section. As stated, verbal labels using this term have been used in many CLT studies. Learners have to assess their perceived difficulty about learning immediately after the task. These are usually on a 1 to 7 or 1 to 5 Likert scale involving terms

¹¹ This result was compatible with other CLT experiments testing the "expertise reversal effect" and "worked examples effect" (Kalyuga, Ayres, Chandler & Sweller, 2003; Leahy & Sweller, 2005).

ranging from “I found this task very easy” to “I found this task very difficult”. Yet, other dimensions of mental effort as well as task difficulty have been identified. These are learner characteristics (e.g. learning styles) and learner-task orientations (e.g. goal orientations).

Another critical factor, as mentioned earlier in this chapter, is the nature of the task as perceived by the learner. If it is not too difficult or too easy, a learner will usually invest an amount of invested effort. In the case where there is a perception that it is too easy or too difficult, the learner may not be willing to summon cognitive resources. According to Cennamo (1993) the effort generated is influenced by presumptions about the effort needed. Bearing this in mind, Paas et al. suggest that rating scales use verbal labels relating to *invested mental effort* rather than *task difficulty*.

In evaluating instructional formats, it would be encouraging for future CLT work to use more than performance data only (e.g. scores and time to completing problems). The role of learner motivation must be taken into account and the Paas et al. method of combining effort and performance scores may provide an alternative starting point.

New Directions in Individual Differences

Looking in depth at the individual learner by an expansion from non-authentic laboratory situations has been a relatively recent innovation in CLT research. Research within realistic learning environments has been completed in some instructional areas (e.g. Grunwald & Corsbie-Massay, 2006; and see van Merriënboer & Ayres, 2005). As such, there are some encouraging signs in catering for individual differences. For example, Neva and Schwartz (2008) have looked at measuring the variations in cognitive load while learning hypermedia where the main variable was sex differences. For the topic of sequencing strategies in CLT, van Merriënboer (2008) has proposed a method using a predetermined sequence of learning tasks that offers self-directed learning. This approach caters more for individual differences of the learner rather than for all learners in general. It encourages learners to take responsibility for performing learning tasks as well as allowing self-assessment of their performance strengths and weaknesses. In addition it enables them to select future learning tasks to improve on deficiencies and enhance performance.

In another study in this area by Kostons, van Gog and Paas (2008); learners were involved in a procedure to allow accurate self-assessment of their individual performance so that they could correctly sequence learning tasks. This was in order to self-regulate their learning process in learner-controlled environments. In addition to this, objective cognitive load measurements were assessed based on individual eye movements and mouse-keyboard operations.

In the area of individual cognitive load measurement, Dalgarno, Kennedy and Bennett (2008) have used fMRI to assess learner’s functional brain activity while they are interacting with a computer tutorial program. This has provided an alternative technique for measuring cognitive load from the self-report and behavior methods.

CONCLUSION

This chapter has outlined CLT and some of its effects, particularly that of the imagination effect and expertise reversal effect. To understand these effects requires an awareness of human cognitive structures and the instructional design principles that flow from them. A failure to implement these may result in procedures that are random in their effectiveness. At the same time for CLT, there is a need to acknowledge there are great variations within individual learners and their levels of motivation for particular learning tasks. Motivation is a multifaceted and complex phenomenon. CLT is just one area that may be able, because of its successful history in instructional design, to take into account the motivation and individual differences in learners to a greater extent.

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Chapter 9

ATTITUDE TOWARDS SCHOOL, MOTIVATION, EMOTIONS AND ACADEMIC ACHIEVEMENT

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ABSTRACT

Attitude towards school is an important predictor of academic well-being (McCoach, 2002; McCoach & Siegle, 2003; Patrick, Anderman, & Ryan, 2002). Furthermore, the underlining motivational and affective components and their relationship with academic achievement are not yet well established.

The present research aimed to explore the relationship between attitude towards school including the motivation and emotions connected to the academic setting, and achievement. The general hypothesis is that the attitude towards school mediates the effects of motivational and affective aspects on academic achievement.

To test this hypothesis we adopted two methods. First, we examined the structural relationships between attitude towards school, motivations, emotions and achievement. Second, we verified the efficacy of an educational training focused on motivation and emotions (Friso, Moè & Pazzaglia, 2004) in improving the attitude towards school. Results confirmed the mediating role of the attitude towards school in shaping the relationship between affective-motivational variables and academic achievement, but also showed a direct influence of self-confidence on school achievement. Educational implications are highlighted.

INTRODUCTION

Obtaining good grades and high achievement levels are important objectives in an academic setting and can be defined as ‘academic success’. Research has mostly focused on

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factors favouring a high cognitive performance in school. Among such factors the most relevant seem to be the use of learning strategies, abilities and metacognition (for a review see Pressley, Yokoi, Van Meter, Van Etten, & Freebern, 1997). However, school is not only grades and academic outcomes. Many other important variables affect well-being in the academic setting for example emotions, motivation, and attitude towards school.

Emotions can be defined as affective responses to external stimuli or internal thoughts, such as expectations, and self-perception (Russell & Barrett, 1999). A common distinction is between positive and negative emotions (Watson, Clark, & Tellegen, 1988). Examples of positive emotions frequently experienced are enjoyment, pride, hope, relief; whereas some of the negative ones are anger, anxiety, boredom, hopelessness, shame (Pekrun, Goetz, Titz, & Perry, 2002). Pekrun, Goetz, Perry, Kramer, Hochstadt and Molfenter (2004) showed the importance of the dimension of arousal, in that certain emotions are activating whereas others are deactivating. The former can sustain motivation (e.g. enjoyment, anger) the latter tend to reduce it (e.g. relief, hopelessness). The importance of positive affect is well documented in both academic and non academic contexts. Positive emotions affect achievement by creating expectations to succeed (Erez & Isen, 2002) and are demonstrated to be a protective factor against stress and intrusive thoughts emerging from negative experiences such as failure. On the contrary, negative emotions are associated with the fear of taking academic risks and impaired concentration (Fredrickson, 2001). Positive emotions can be raised by positive teacher-student relationships and a positive school environment (Roeser, Midgley, & Urdan, 1996).

Motivation refers to a wide range of aspects capable of sustaining, driving and initiating behaviour. Amongst which are self-efficacy (Bandura, 1997), expectancies and values (Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1983) and goals (Linnenbrink & Pintrich, 2002). Goals give purpose and focus to the activities one is planning or performing (Pintrich, 2000). They can predict the choice of task difficulty and shape the meaning given to the results obtained, as well as the value assigned to learning and self-perception. A classification which has gained a large consensus in the literature is the distinction between mastery and performance goals (e.g. Dweck, 1999). Mastery goals are characterised by the evaluation of competence through self-referenced perceptions of growth or improvement; whereas performance goals are characterised by demonstrations of one's ability, achieved by positive judgements such as 'you are smart', avoidance of demonstrations of inability, social comparison and competition. Mastery goals are linked to an incremental theory of intelligence focused on the improvement of abilities, whereas performance goals are more in line with an entity theory, focused on the results obtained. Compared to entity theory, the incremental theory decreases the students' vulnerability to failure and sustains well-being. This has been demonstrated by Kaplan and Maehr (1999) who examined the influence of mastery and performance goals on well-being in school, considering both teacher reports and students' self-reports. They found that mastery goals and emphasis on improvement rather than on competition was related to positive school affect, feeling of school belonging and well-being. On the contrary, ability focused settings, stressing performance goals promoted feelings of frustration and disaffection.

Attitude towards school can be defined as the way a person perceives his/her school attendance. Typical statements are: 'I feel well when I am in class', 'I willingly go to school', 'What I learn in school can help me to achieve future goals (e.g. obtaining an interesting job)', 'I have supportive teachers', 'I have positive relationships with my peers' (McCoach,

2002; McCoach & Siegle, 2003). Attitude towards school depends on both cognitive and affective aspects and both social (relationships) and individual aspects, such as goals (Patrick, Anderman, & Ryan, 2002). Attitude towards school is related to both the school and psychological environment (Andersen, 1982), i.e. the meaning given by students to the social environment which depends, following a socio-cognitive approach, on individual interpretation, academic values and subjective perceptions. Following Maehr's (1984) theory of personal investment, the meaning and the value given to an activity are very important because they determine motivation, engagement and how much time and energy will be invested in a task. In turn, meaning depends on factors such as goals, self-efficacy, action possibilities, classroom environment, perceived peer and teacher relationships.

Being valued and respected gives meaning to the study activities and sustains positive affect through thoughts such as 'I invest because peers/teachers value me and think I can succeed'. A supportive academic setting reduces negative affect in general and anxiety in particular and sustains academic motivation (Boekaerts, 1993). When students feel accepted and are considered as valued members they are more likely to pursue mastery goals. On the contrary, if students perceive not to be accepted and considered mainly for their results they develop performance goals, tend to make comparisons and become competitive (Anderman, 2003; Nelson & DeBacker, 2008).

All these results, suggest that to increase well-being in school and create an adaptive pattern of cognition and affect (i.e. a positive attitude toward school) there should be an environment characterised by no threat to self-worth (Covington, 1998), no anxiety to outperform others, no excessive worries linked to evaluation (Dweck, 1999). To enjoy school and to develop self-competence without excessive anxiety and worries regarding performance, students should have caring teachers who communicate affect, mastery goals and provide a secure emotional basis (Boekaerts, 1993). Such kind of supportive adults meet the students' needs for relatedness, autonomy and competence postulated as innate and universally specified (Deci & Ryan, 1985), which, in being fulfilled, determine the individuals' well-being (Ryan & Deci, 2000).

Consequently, attitude towards school could be shaped by appropriate goals and values, positive affect, supportive interpersonal relationships and a caring environment (Battistich, Solomon, Kim, Watson, & Schaps, 1995; Nelson & DeBacker, 2008). These factors should favour personal involvement and promote an internal locus of control. Moreover, they should meet social goals, such as social responsibility, intimacy and approval (Urduan & Maehr, 1995).

The current study focuses on adolescent students, with the general aim to understand the association between motivation, emotions, attitude towards school and achievement. There is evidence suggesting that school-related worries increase (McGuire, Mitic, & Neumann, 1987) and class belonging and classmate involvement decrease (Nelson & DeBacker, 2008) during adolescence and this can negatively affect the students' attitude towards school. More than younger students, adolescents need supportive adults who do not judge them, but rather help them by emphasising individual effort and improvement rather than ability and competition (Midgley, Anderman, & Hicks, 1995).

Until now, the relationship between attitude towards school, emotions and motivation has been studied considering only one or two items at a time without considering the interrelationships and the possible mediating role one factor may have on the other. To our

knowledge, no research has investigated the relationship between emotions in school, motivation, attitude towards school, and academic achievement in a single model.

Our general hypothesis was that attitude towards school mediates the effect of emotions and motivation on academic achievement. To verify it we adopted two methods.

First, in a large sample of high-school students, we tested a model of the relationship between affective and motivational aspects of schooling, attitude towards school and academic achievement in which we measured both the direct effect of affective-motivational variables on academic achievement and the mediating effect of attitude towards school.

Second, in a restricted sub-sample, an evaluation was carried out on the effects of a three months once-a-week training program, on the students' attitude towards school. The training program focused on the emotional and motivational aspects of school life.

The predictions were that:

1. motivation and emotions in school affect academic achievement through the attitude towards school, i.e. the mediated effect is stronger than the direct one;
2. training on emotions and motivation increase not only the specific aspects stressed but also improve the attitude towards school.

METHOD

Participants

A total of 130 students aged fifteen (121 females), from a high school in the north-east of Italy participated in this study.

Materials

Scales for the Assessment of Motivational and Affective Variables

In order to assess the motivations involved in school learning, we used six self-rating scales, all derived from an Italian battery for the assessment of motivational and strategic variables in learning (AMOS, De Beni, Moè & Cornoldi, 2003). In particular, two scales – respectively on self-confidence about learning and learning goals - were analyzed in the present study. The self-confidence scale comprised five items, which required respondents to assess their own learning ability, their ease in learning new academic topics, their actual academic achievement, its' importance for their personal life, and their view on the chance of improving their own academic success in the future. The scores for each items were from 1 = scarce, to 5 = excellent. The total score was the average of the scores assigned to each single item. The scale on learning goals comprised four items which result in a choice between mastery-oriented and performance goals. One mark was scored for each mastery-oriented choice, and their sum provided the total score. Affective variables were assessed using three scales (QAES, Mega, Moè, Pazzaglia, Rizzato, De Beni, 2007), each composed by a variable number of positive (e.g. confidence, delight, hope, interest) and negative (anger, sadness, boredom, fear) emotions. Respondents were asked to rate often they experienced each

emotion, on a 1 to 5 Likert scale, with reference to (1) themselves, (2) themselves as students, and (3) during study activities. For the goals of the present study we analyzed the responses relative to point (2), which provided two separate mean scores, one for the positive and one for the negative emotions. The attitude towards school was assessed by a 31-item 6-point self-rating scale (TAS, Friso, Moè & Pazzaglia, 2005) where 1 = not at all and 6 = completely. Items regarded various aspects of the school experience: relationship with teachers, classmates and parents, interest in academic topics, and so on (see Appendix A). The total score was the sum of the single items, after reversing those expressing a negative attitude towards school (e.g. items 6, 7, 9, 11, 15, 16, 22, 26, 30). The psychometric properties of the scales described above were analyzed in previous studies (Mega et al., 2007; Friso et al., 2005) and were in general satisfactory.

The Training for the Improvement of the Attitude towards School (ATS Training)

This is an educational training program (Friso et al., 2005), aimed at improving the attitude towards school in adolescence. The rationale is that attitude towards school depends on a series of strategic, motivational, social, and metacognitive variables. As a consequence, the whole program is divided into three areas, with activities focused on metacognitive/motivational, social and emotional variables. Each activity starts with narratives and/or comics representing typical episodes of school life, with the aim of promoting the students' reflection on strategic learning, intrinsic/extrinsic motivation toward learning, learning goals, relationship with peers and teachers, life satisfaction, and so on. Lists of questions, stimuli for discussion, requests to chose the narratives' ending and characters' behaviours are provided in order to promote self-reflection and productive discussion among students and with their teachers. Two examples of activities are shown in table 1.

Table 1. Two examples of activities presented during the training



Have you ever felt like Sabrina? Tell me...

.....

What means “taking up the challenge”?

.....

.....

Does Sabrina do well to give up? What else could she say or think?

.....

.....

How could you help Sabrina to increase her confidence?

.....

.....



How do you feel when teacher is handing out the tests in the classroom?

.....

.....

Do you think it's correct for the teacher to hand out the tests starting from the best results? Why?

.....

.....

What do you think about Luisa's answer? Is it possible to learn from mistakes?

.....

.....

Procedure

All the scales were administered to the whole sample of students during the first months of the school year (October and November), in the following order: scales on emotions, motivational variables and attitude towards school. After that, from January to April, 95 students performed all the activities of the ATS training, in classroom and under the direction of a curricular teacher. Sessions took place weekly and lasted about 90 minutes, for a total training time of 20 hours. In the meantime the 35 students in the control group attended their regular school activities. At the end of April all the students again completed the scales in the same order as in the first administration. In June, at the end of the school year, students' marks were recorded and averaged, as an index of academic achievement, given that there is evidence of a high inter-correlation between grades in core subject areas (Möller & Köller, 2004).

RESULTS

Descriptive Statistics

Mean and standard deviations of all measured variables are presented in table 2.

Table 2. Descriptive statistics of all variables (n=130)

Variable	Mean	SD
Negative Emotions	2.07	.64
Positive Emotions	3.05	.63
Self-confidence	3.51	.55
Mastery goals	.51	.35
Attitude toward school	139.14	13.61
Academic achievement	6.2	.69

Correlation between Variables

Correlations were statistically significant in most cases (see table 3). In particular it is worth noting that scores pertaining to attitude towards school have quite high and significant correlations with motivational and emotional indices, as well as with academic achievement.

Table 3. Intercorrelations among variables

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Negative emotions	-					
(2) Positive emotions	-.17	-				
(3) Self-confidence	-.58*	.40*	-			
(4) Mastery goals	-.30*	.34*	.47*	-		
(5) Attitude toward school	-.43*	.41*	.53*	.31*	-	
(6) Academic achievement	-.41*	.22*	.53*	.17	.23*	-

*= $p < .05$.

Relationship between Attitude towards School and Motivational-Affective Variables

Considering that TAS was administered at the beginning of the school year and marks were recorded at the end of the school year, we can claim that the attitude towards school can be used as a predictor of academic achievement. In order to consider this issue in more depth, we compared two path models examining the direct and mediated relationship between motivational, emotional and attitude measures and academic achievement. The hypothesis which inspired the current study was that the influence of emotional and motivational variables on school achievement would be mediated by the attitude towards school. In other words, we intended to test a model in which motivational and emotional factors contributed to the attitude towards school, and only the latter was in direct relationship with school achievement. However, the pattern of results presented in table 3 could suggest a number of alternative models. For example, given the high correlation between self-confidence and school achievement, or between the latter and negative emotions, it was plausible to expect that their influence on academic achievement was direct and not only mediated by the attitude towards school. Amongst the various possible models, two of them fitted the data best. For comparison, their Fit Indexes are presented in table 4. In model A) the relationship between school achievement and the motivational and emotional variables is entirely mediated by the attitude towards school. In model B) self-confidence plays a causal role on school achievement both directly and indirectly through the attitude towards school and emotions.

Table 4. Summary of Goodness of Fit Indices of Models A and B

Fit Index	Model A	Model B
χ^2 (<i>df</i>)	120 (8)	6.37 (5)
Normed Fit	.455	.971
Comparative Fit	.454	.993
Goodness of Fit	.78	.985
RMSEA (CI 90%)	33 (.27 - .38)	.013 (.0 - .13)

It is quite evident that model B's fit indices are clearly superior to those of model A and better satisfy the criteria of a Good Fit (Schermelleh-Engel, Moosbrugger & Müller, 2003).

The path model of Model B with corresponding standardized coefficients is presented in figure 1.

As can be seen, following this model, some effects on academic success are direct and some others mediated by the attitude towards school. Negative emotions, positive emotions and mastery goals affect academic achievement through the mediation of the attitude towards school. On the contrary, self-confidence has both a direct and indirect effect on academic achievement. The mediation is through the attitude towards school and emotions. Moreover, mastery goals affect the attitude towards school also through the mediation of positive emotions.

Overall, the model shows the critical role of emotions in affecting attitude towards school per se and in being affected by mastery goals and self-confidence.

The model shows different patterns for motivational and for affective variables. Motivational variables affect academic achievement directly or through the mediation of emotions. Emotions affect attitude towards school which in turn affects achievement.

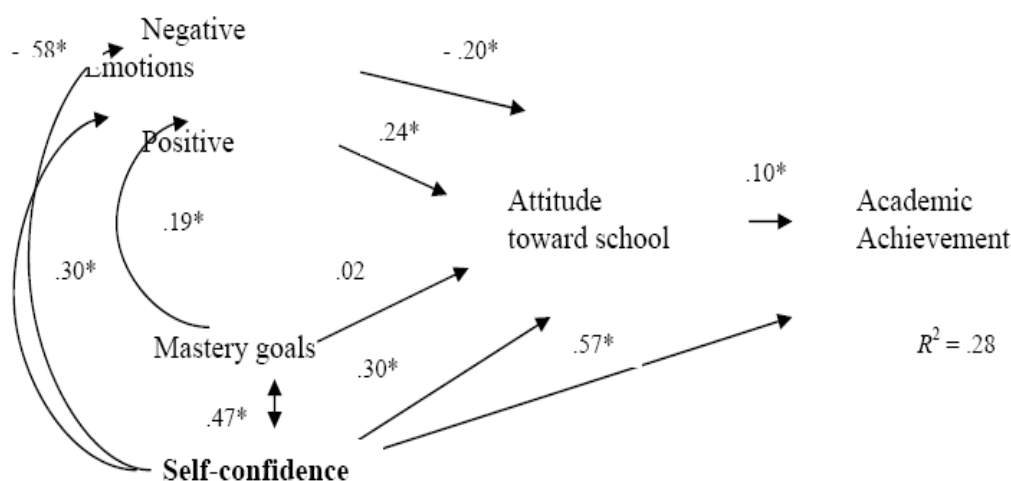


Figure 1. Path model and standardized coefficients of model B.

The relationship between attitude and academic achievement is very small. This means, providing that the model has a good fit index, that there are a lot of significant relationships between emotions, motivation and attitude, but a much lighter relationship between attitude and academic achievement. In other words, a positive attitude towards school is partly distinct from objective results, i.e. marks, and depends more on high positive emotions, low negative emotions, mastery goals and self-confidence.

Efficacy of the ATS Training in Improving the Affective/Motivational Variables and the Attitude towards School

A subgroup of 34 trained participants, each of them matched to a member of the control group for the TAS scores in the first administration, were selected. The selection followed the rationale of creating two groups of students of the same age and gender composition, paired for the TAS scores recorded at the beginning of the school year, but different in regards to training condition, with a trained and an un-trained group. Two participants of the trained group were excluded from the analysis because they did not participate in the re-test phase.

First of all, we tested whether the ATS training had a positive effect on the attitude towards school, as measured by the TAS scale. A 2 x 2 analysis of variance (ANOVA) for repeated measures, performed on the TAS scores, with group (trained vs. un-trained) and time (test vs. re-test) as main factors, showed a significant effect of group by time interaction, $F(1,64) = 13.32$, $MSE = 55.87$, $p = .001$. Post-hoc comparisons between means revealed the expected pattern of results for the trained students, whose scores at the end of the school year ($M = 138.00$, $SD = 14.17$) were higher than those at the beginning ($M = 132.97$, $SD = 13.05$), $t(31) = 2.53$, $p = .017$. An opposite pattern of results emerged for the un-trained group, which showed a significant decrease from the first ($M = 133.18$, $SD = 12.73$) to the second ($M = 128.71$, $SD = 14.67$) TAS administration $t(33) = 2.65$, $p = .013$.

A 2 x 2 x 2 ANOVA, with group (trained vs. un-trained), time (test vs. re-test), and type of emotions (positive vs. negative) as main factors was calculated on the scores of positive

and negative emotions. The analysis showed a significant group by time by kind of emotions interaction. Post-hoc comparisons on negative emotions revealed that the un-trained group was affected by a significant increase in the frequency of negative emotions, $t(33) = 2.36$, $p = .024$, whereas the scores of the trained group did not change from the beginning to the end of the school year, $t < 1$. No significant effects were found for positive emotions, neither relative to groups, nor to time. Table 5 and 6 report the mean scores and SD of TAS and emotions, respectively, broken down for group and time.

Table 5. Mean scores and SD of attitude toward school, broken down for group and time

Group			
	Time		
		Mean	SD
Trained			
	Test	132.97	13.05
	Re-test	138.00	14.17
Un-trained			
	Test	133.18	12.73
	Re-test	128.71	14.67

Table 6. Mean scores and SD of negative and positive emotions, broken down for group and time

Emotion				
	Group			
	Time			
Positive	Trained		Mean	SD
		Test	2.88	.53
	Re-test	3.03	.63	
Un-trained	Test	2.95	.68	
	Re-test	2.93	.61	
Negative	Trained	Test	2.34	.77
		retest	2.25	.73
	Un-trained	test	2.09	.58
		retest	2.34	.89

Then, two group by time ANOVAs were computed on the motivational scores, but they did not show any significant effect.

The comparison between the trained and un-trained groups highlighted the importance of including in the school curricula programs a number of activities that promote self-reflection and discussion among students on important topics such as their well-being in school, their relationship with classmates and teachers, their interest in school topics, the practical impact of what they learn in school on their every-day life and future profession. Our data show that these kinds of activities prevent students from experiencing increased negative emotions at the end of the school year compared to the beginning. Moreover, these activities proved effective in enhancing the attitude towards school and in preventing its deterioration during the scholastic experience.

CONCLUSION

How can students get the most from attending school ? What is 'success' and what can predict it ? Success can depend on marks or on other aspects that favour well-being such as the psychological environment, a positive attitude and good relationships. These factors can affect personal involvement and consequently achievement and marks.

Following this perspective, the first level of 'doing well' in school is to find supportive teachers who communicate affect, acceptance and positive expectations, and value effort above results, thus favouring a motivational approach characterised by a prevalence of mastery goals and positive emotions. The second level, providing this positive attitude has been reached, concerns achievement, which is favoured and becomes important as part of self-schemata once all has been done to promote personal well-being.

Stemming from this approach to the educational process, the present research explored the role of 'attitude towards school', defined as the willingness to attend school. We wished, first to explore the interrelationship between motivations, emotions and attitude towards school; and secondly to compare attitude towards school with school achievement

To this end, we measured attitude towards school, emotions and two motivational aspects, namely self-confidence and mastery goals, and examined a) their relationship and b) their effects on academic achievement. The model we found showed that attitude towards school is predicted by all the emotions and the motivational aspects considered, directly or indirectly, and that attitude towards school affects academic achievement. As hypothesised attitude towards school mediated the relationship between each of the motivational and affective variable explored and academic achievement. Moreover, self-confidence affected achievement directly and relationships involving motivations were mediated by emotions.

This pattern of relationships sustains the feasibility of improving the attitude towards school through a training program aimed at promoting emotions and motivation in school. Results obtained by such a training program confirmed its positive effects on attitude towards school and on emotions. Specifically, positive attitude towards school increased in trained subjects and decreased in the non trained group. Negative emotions increased in the non trained group but were unchanged in the trained one. Contrary to the hypothesis, no significant effect was found on the motivational aspects. Perhaps, motivation is long standing and more time and effort is needed to change it.

Results obtained with the model and the training program stress the importance of emotions. There is a growing interest in the importance of affective reactions in school (Efklides & Volet, 2005; Schutz & Lanehart, 2002). Following Fredrickson (2001) "positive emotions are means to achieving psychological growth and improved well-being over time" (p. 218). Positive emotions can overcome difficulties created by the effects of negative emotions. Thus it not enough for a person to have has low or medium negative emotions but rather, it is necessary to engender and promote higher positive emotions. Pekrun, Goetz, Titz and Perry (2002) and Goetz, Frenzel, Hall, & Pekrun (2008) also highlighted the importance of positive emotions in the academic contexts, since they were seen to activate self-regulation, motivation and the allocation of cognitive sources. In addition, we found that they also strongly affect the attitude towards school and are an important mediator of the relationship between school motivational aspects such as mastery goals and self-confidence on attitude towards school.

The model shows a strong relationship between mastery goals and self-confidence. Due to its correlation nature, it is difficult to speculate about the direction. Do students who perceive to succeed develop mastery goals or, is the opposite true, i.e. do mastery goals sustain the perception of success? Do students who feel not so confident in successfully overcoming school tasks develop performance goals and hence escape from situations where the risk of demonstrating their inability is high (i.e. from difficult or new tasks) or are performance goals that affect self-confidence? In so doing they enter a vicious circle where they become less and less confident. No matter the direction, it is interesting to note that self-confidence is the only variable directly related to all the others. Being self-confident is an important step because it can foster mastery goals, favour positive emotions, create a decrease in negative ones and affect attitude towards school and academic achievement directly and indirectly. It must be noted that self-confidence is the only variable which significantly affected a decrease in negative emotions, thus favouring a positive attitude towards school.

In addition, the relationship between attitude towards school and academic achievement is not significant per se, but the model has overall a strong internal coherence. Thus, whereas there are many and strong links between emotions, motivation and the students' attitudes towards school, the link between these factors and academic achievement are fewer and more tenuous. In other words, students may experience well-being in school, feel more positive and less negative emotions, have effective motivations without necessarily achieving higher academic success. To feel well in school seems to depend more on the emotions and motivations experienced than on objective results or academic marks. This is an important point outlined by our results.

Taken together, the results outline some educational implications and stress the importance, from a practical point of view, of designing environments that foster positive emotions, also through an increase in self-confidence and mastery goals. Training programs for students are efficacious, but to maintain the results obtained effective teachers are needed. To this end, teachers should be invited to enhance students' positive affect. This can be done by communicating enthusiasm, affect, mastery goals, showing the meaning of what is studied or done, stimulating curiosity and giving – wherever possible – practical demonstrations or examples (Pekrun, 2006). Self-confidence can be increased also by positive results and feedback that should stress the students' positive engagement and effort and be individualised and specific. Excessive criticism for disengagement or failure and social comparison should be avoided. There is evidence suggesting that feedback stressing external locus of control decreases intrinsic motivation (e. g. Ryan & Deci, 2000).

Last, but not least, teachers should be self-confident themselves and have mastery goals so as to communicate this motivations to their students. The same may apply to parents. A student who is valued for his/her progress in school, but is judged by parents only on the basis of objective results may experience a contradiction and feel confused. It is a well established fact that children and adolescents develop the same system of meaning of the social environment in which they belong (Dweck, 1999). Consequently training devoted to adults, teachers and/or parents, should be welcomed, because a person cannot communicate emotions or motivations he/she does not feel or endorse him/her self.

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APPENDIX A

The Attitude Towards School scale (English version from: TAS, Friso et al., 2004)
There is a list of sentences below, relative to different aspects of the school experience. Read them and score for each one how much that sentence is true for you, from 1 = not at all , to 6 = completely.

1. What I have learned so far, makes me want to continue studying.
2. I believe that in order to achieve my professional goals I need an adequate preparation.
3. School attendance is quite expensive.
4. I succeed in reconciling study time with extra-scholastic activities.
5. School is where I study and meet friends.
6. I attend this school because my friends are here.
7. As I grow older I understand this school is not for me.
8. What I have learned is in line with what I expected to learn.
9. Every day I am scared of having to go to school.
10. I consider myself satisfied with my scholastic situation.
11. Working is better than studying.
12. I would quite happily give up going out with friends to spend some time studying.
13. Attending school is useful for my future.
14. I think that attending college is very demanding.
15. I would like to change school.
16. If I failed at school I would find a job.
17. My parent's support helps me overcome failures at school.
18. Some teachers make me want to study.
19. A good relationship with my peers has an influence on my commitment to studying.
20. My friends help me overcome school difficulties.
21. When I started attending this high school I intended to continue to university.
22. I study and carry out my homework only because I am forced to do so.
23. The type of relationship with my teachers has an influence on my academic success.
24. My parents approve of my choice of school.

- 25. I am happy about how my teachers teach.
- 26. I would rather not attend university because it would be a long and difficult road to travel.
- 27. If I failed I would feel guilty.
- 28. My parents did not influence my choice of schooling.
- 29. I am satisfied with my school environment.
- 30. My teachers don't appreciate me.
- 31. I like my classmates.

In Italy after 'middle school, i.e. around 14 years of age, children can choose between a number of different high schools with either a more 'academic' or 'professional' outline. The former tend to be in preparation for university and can either have a more scientific (maths, sciences, etc), literary (Latin, Greek, literature) or linguistic curricula. The latter tend to prepare students for more specific working environments e.g. commercial, or teaching. Furthermore, in both types of school, if a child fails a number of subjects during a particular year (i.e. by obtaining low grades), s/he may have to repeat that year, thus finding him/her self in a different class, carrying out the same program s/he carried out the year before.

Chapter 10

**INDIVIDUAL DIFFERENCES IN ATTITUDE TO SCHOOL
AND SOCIAL REPUTATION AMONG PEERS:
IMPLICATIONS FOR BEHAVIOURAL
ADJUSTMENT IN EDUCATIONAL SETTINGS**

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ABSTRACT

Behavioural adjustment problems in schools are becoming matters of increasing concern among professionals of education and psychology. Although it is well-known that adolescence is a period of particular risk for involvement in antisocial activities, there are still questions to be addressed if we are to understand the *whys* behind such behaviours, and especially why this problem is present or is more serious in some adolescents than in others. There is now greater consensus among researchers regarding the role played by family in the origin and development of behavioural problems in children. Particular characteristics of the family environment, such as negative or avoidant communication between parents and children and the lack of parental support, have been highlighted in this context. However, an intrinsic feature of the adolescent period is its opening to new relations with significant others apart from parents, mainly peers and teachers, as well as to new social contexts such as the school.

In this communication we analyse the relevance of social life at school, school environment and school experience in adolescent behavioural adjustment. We particularly examine the link among social experience at school and other two factors that have caught the attention of researchers in the last two decades but that unfortunately have not been addressed in depth in the scientific literature: we are referring to attitude to formal authority and social reputation among peers. With attitude to authority we refer in the present communication to the attitude the adolescent holds towards the school as a

formal institution and towards teachers as formal figures. Social reputation among peers makes reference to the social recognition on the part of others in the same classroom or school. Both factors, namely *attitude to school* and *reputation among peers* seem to be closely associated to antisocial behaviour among students and, from our point of view, both deserve more attention as well as a jointly consideration and analysis due, on the one hand, to their link and join contribution to the explanation of certain risk behaviour that occur in schools and, on the other hand, to their important implications for the design of prevention and intervention programs at the school settings.

SHORT COMMUNICATION

Behavioural adjustment problems in schools have lately become a significant concern for teachers, parents, psychologists and society in general, due to the negative consequences these behaviours have for the teaching-learning process, the psychological adjustment of aggressors and victims, as well as quality of social interactions in educational settings (Estévez, Musitu, & Herrero, 2005; Smith & Brain, 2000). Although it is well-known that adolescence is a period of particular risk for involvement in antisocial activities, it is also true that there are significant individual differences in the frequency and stability of such behaviour. Thus, and following Moffit's (1993) adolescence-limited and life-course-persistent antisocial behaviour theory, some adolescents will not participate at all in such behaviours along this developmental period, many of them will behave antisocially temporarily, and few of them will show a persistent and stable antisocial behaviour; stability of this behaviour seems to be closely linked to its extremity.

For the minority of youths who commit extreme antisocial behaviours, Moffit suggests that there is a causal sequence beginning very early in life with the formative years are dominated by cumulative and negative person-environment interactions. She argues however that apart from these extreme cases, almost all adolescents commit some antisocial or even illegal acts, which can be understood as an *adaptive response to contextual circumstances* and even *normative* rather than abnormal. And finally others abstain completely, thus raising questions about the factors explaining these individual differences.

FACTORS RELATED TO BEHAVIOURAL ADJUSTMENT IN ADOLESCENCE

Research focused on factors that may underlie these problems has documented the association between antisocial behaviour in adolescence and particular individual and social factors, these latter relating mainly to family and school contexts, the most important social contexts for development and psychosocial adjustment in this period of life. Studies examining the link between individual characteristics and behavioural adjustment in adolescence have stressed the role of biological, genetic and organic pathological syndromes, as well as psychological variables such as a tendency to irritability and impulsiveness, low frustration tolerance (Baron & Byne, 1998), general low satisfaction with life (MacDonald, Piquero, Valois, & Zullig, 2005), and lack of empathy or the ability to put oneself on another's place. On this last, for example, some adolescent offenders have been found to be

unable to anticipate the negative consequences of their actions for their victims (Dykeman, Daehlin, Doyle, & Flamer, 1996; Evans, Heriot, & Friedman, 2002; Olweus, 2005). It is also possible, however, that in other cases aggressors carry out these actions fully aware of the negative consequences of their acts and precisely because their motivation is to cause hurt; in these cases there is a considerable gap in the development of the emotional dimension of empathic skill.

With reference to contextual factors, research has regularly linked family environment and school environment on the one hand to psychosocial and behavioural adjustment problems in adolescence on the other (Estévez et al., 2005; Murray & Murray, 2004; Stevens, De Bourdeaudhuij, & Van Oost, 2002). The quality of adolescent-parent, adolescent-peer and adolescent-teacher interactions influence, and may determine, the way adolescents perceive themselves in relation to others, their attitudes, and their behaviours (Estévez, Jiménez, & Musitu, 2007; Jessor, 1991; Werner, 2004). In this respect, there is considerable consensus among researchers regarding the role played by the family in the origin and development of behaviour problems in children. Particular characteristics of the family environment such as the presence of frequent and unresolved conflicts (Crawford-Brown, 1999; Cummings, Goeke-Morey & Papp, 2003), lack of parental support (Barrera & Li, 1996), and negative communication or absence of communication with parents (Dekovic, Wissink, & Meijer, 2004; Stevens et al., 2002), enhance the probability of developing socially inappropriate behaviours in other social contexts such as the school.

This can be explained in part because social interactions in the family context may either foster or inhibit abilities such as empathy, which are in turn closely related to antisocial behaviour against others. As Paley, Conger, and Harold (2000) remark, children establish their first social relations with parental figures and the nature of those parent-child relationships and the context in which they are sustained may determine the social skills and social relations the child will develop with others later in life and in other settings. Henry, Sager and Plunkett (1996) found that adolescents with parents who engage in positive reasoning to solve problems, and who described their families as high in cohesiveness, were more likely to report higher levels of perspective taking when trying to understand another individual's feelings or emotional state. Also Estévez, Murgui, Musitu and Moreno (2007) found, in a sample of adolescents, a mediating effect of empathy in the relation between quality of family environment and involvement in violent aggressive behaviours at school.

But it is also true that an intrinsic feature of the adolescent period is its opening to new relations with significant others beyond parents (mainly peers and teachers) and to new social contexts such as the school. If family environment is an important buffer against antisocial behaviour, commitment to school and social relations with classmates and teachers are not less relevant. The conclusion in Thornberry's and colleagues (1991) work is that both attachment to parents –defined in their study as perception of warmth, liking, and absence of hostility in family interactions– and attitude towards school play a major role in explaining adolescent involvement in antisocial behaviours. School factors, then, must be also considered in depth.

SCHOOL ENVIRONMENT AND SCHOOL EXPERIENCE

The term *school environment* refers to the social construction of interactions and perceptions that teachers and students develop about the school context (Trickett, Leone, Fink, & Braaten, 1993) and, therefore, it is a reflection of positive or negative feelings about the social climate of the context in which they all interact (Peterson & Skiba, 2000). A positive school environment exists when students feel comfortable, valued and socially accepted in a climate based on support, mutual respect and trust (Moos, 1974). Yoneyama and Rigby (2006) distinguish two principal elements that constitute this positive climate, the first being support and respect from teachers, and the second enjoyment of relationships with peers in the classroom. Moos, Moos and Trickett (1989) also considered these two dimensions, identified by them respectively as teacher support and affiliation among peers; the former refers to the amount of help, trust and attention the teachers offer to students, the latter to the degree of concern and friendship students feel for one another. These authors add a third dimension to define the school environment, namely involvement in school activities, which refers to degree of students' attentiveness, interest and participation in class activities.

Research has shown, on the one hand, that quality relationships with teachers buffers against development of misbehaviours at school, while negative teacher-student interactions adversely affect students' psychosocial and behavioural adjustment in schools (Blankemeyer, Flannery, & Vazsonyi, 2002; Reinke & Herman, 2002). On the other hand, peer relations in educational settings may also significantly influence adolescent's emotions and behaviours. Peers can exert a crucial influence on participation in risk behaviours and antisocial acts (Dishion, 2000; Barnow, Lucht, & Freyberger, 2005), but they can also provide beneficial opportunities to learn socially accepted values and attitudes, or to acquire interpersonal skills such as the ability to handle conflicts (Hartup, 1996; Laursen, 1995).

Considering the three dimensions of school environment proposed by Moos et al., (1989), research has documented that perceiving peers in the classroom as friends or colleagues, having positive interactions with teachers, as well as being academically successful, are factors related to perception of school as a useful learning context for the acquisition of relevant knowledge and for future social promotion, and as a valuable setting in which to share enriching experiences with others. Students sharing those perceptions will feel more comfortable and liked in this setting, will express more positive attitudes towards teachers and the school, and will not normally exhibit behavioural problems in this context (Jack et al., 1996; Molpeceres, Lucas & Pons, 2000; Samdal, 1998). A negative school climate, in contrast, based on unhealthy teacher-student and classmates-student interactions, reduces students' academic and social prospects (Moote & Wodarski, 1997; Murray & Murray, 2004). This fact is extremely important if we take into account that school experience is a key factor related to the subsequent orientation towards institutional systems as a whole, with clear implications for conformity with established social norms (Emler, 1993; Rubini & Palmonari, 1998), as we will analyse in more depth in the following section.

School experience is therefore a key aspect in relation to adolescent psychosocial and behavioural adjustment that seems to go even beyond what one may consider *normative* misbehaviours or *minor* antisocial acts. Recent work as part of the Edinburgh Study of Youth Transitions and Crime has shown that some of the most important factors related to criminal records and delinquency in adolescence belong to the educational setting. McAra and McVie

(2007) concluded that having being excluded from school in secondary education and leaving school at the age of 16 were among the stronger predictors in this sense. Smith (2006) found that both truancy and school exclusion, together with level of attachment to teachers and parental commitment to school were closely correlated to misbehaviour at school, and also to delinquency.

These results raise the question of the effectiveness of including expulsion from school as a measure to reduce or prevent new misbehaviours and to punish aggressors. Tyler (2006) argues that people obey established norms and social rules if they believe these norms and rules are legitimate and if they respect formal figures and institutions, and not just because they fear punishment. This idea is again connected to the attitude people hold towards authority. Is school exclusion always interpreted as a punishment by the aggressor? If there is no trust in school authority, one could even imagine that this measure would be interpreted as a *gift* for some of them, as a badge of honour in their search for a reputation as rebellious and non-conforming.

REPUTATION AMONG PEERS

Emler and Reicher (1995) propose that some young people may act knowingly to foster a bad reputation. In order to understand the actions of young people so motivated, these authors point out that “it is necessary to appreciate the social framework within which of their actions occur. Two features of this framework are considered in particular; each assumes a special importance in adolescence. One is the institutional framework of society, experienced most directly by adolescents through their formal education and through contacts with various agencies of the state. The other is the informal social group, and in particular the peer group.” (p. 143). The institutional framework is examined in more detail in the next section. Here we consider the relationships between reputation among peers and involvement in antisocial behaviours.

Barry (2006) interviewed 40 youths with serious behavioural problems, the majority of them stressing as an important reason to behave antisocially the need “to gain a sense of belonging through identity with friends” (p. 48). Barry also argues that “many of these young people suggested that their family upbringings had not been a source of support or encouragement for them, resulting in them often turning to friends for company and social identity”. Thus, creating and sustaining a reputation among friends seems to be a key factor to understand some adolescents’ propensity to participate in risk activities and display behavioural adjustment problems. From this perspective, antisocial behaviour may be understood as part of a reputational project in which the first *witnesses* are peers in whose company the act is carried out, and the choice to break rules is a public self-presentation to gain a particular kind of identity (Emler & Reicher, 1995).

According to these authors, the establishment, maintenance and enhancement of a reputation is essential to all adolescents –especially among peers– and with that purpose, they choose a particular self-presentation to publicly promote this reputation. For some, the deliberate choice is an antisocial or even delinquent self-image. Hence, as Emler (in press) points out, one may regard reputations, including *delinquent reputations* as in fact among the goals of such acts. As other studies have also indicated, involvement in risk (or even illegal)

activities can be rewarding for some youths in terms of their perceived status with friends (Carroll, Hattie, Durkin, & Houghton, 2001; Carroll, Houghton, Hattie, & Durkin, 1999). In the study of reputation conducted by these authors (Carroll et al., 1999, 2001), both adolescents at-risk and those who behaved antisocially regarded themselves as non-conforming and wanted to be perceived by others in this way (for example, they liked to be known for breaking rules or doing things against the law). For members of these groups, therefore, norm-breaking goals were significantly more important than for the group of not at-risk adolescents who reported a higher educational goal orientation and gave more priority to their academic image than to their social image.

But what are the *whys* behind the search for a delinquent reputation? Emler (in press) suggests that youth turn to antisocial behaviour basically as a result of their disappointment or lack of trust in authorities. This process may start at home, or at school when children increase contact with other peers, on many occasions beyond the supervision of adults. In this new social environment, they are exposed to both positive and negative acts on the part of others, and in the case of the latter might normally look to school authorities (or even the criminal justice system) for protection. As children approach adolescence, they start questioning those formal authorities as they realise that their protection is not perfect. Thus, for some, antisocial behaviours are attractive precisely because they appear to offer an alternative source of protection, through the achievement of a reputation based on strength, bravery and toughness. In the next section we analyse in more detail the role played by attitudes to teachers and school as authority figures and formal institution.

ATTITUDE TO SCHOOL AND TEACHERS

In Hirschi's classic, *Causes of Delinquency* published in 1969, the author argues that human beings have a natural tendency towards deviance. For this reason he finds it more interesting to ask why people *do not deviate*. His explanation is that that tendency is controlled by the individual's bonds to society. In particular, Hirschi talks about four elements that reduce antisocial behaviours: (1) attachment to others (e.g. parents and teachers in adolescence), (2) commitment to conformity, (3) involvement in conventional activities, and (4) belief in the moral validity of conventional values and social norms. Moreover, as other authors such as Thornberry and colleagues (1991) have suggested, it seems that there is a temporal causal ordering starting with attachment to parents followed by commitment to and involvement to school, followed in turn by acceptance society's norms.

In particular and according to Hirschi, adolescents with strong attachment and commitment to school are less likely to engage in deviant activities than those with weak bonds. Subsequent longitudinal studies carried out with youths from different cultures have supported his conclusions, showing that these two factors are negatively associated with antisocial behaviour (Leblanc, 1994; Torstensson, 1990). Gottfredson (2001) defines, in this context, attachment to school as an emotional link and the extent to which the person likes school or finds the work done there as satisfying; commitment refers to having an educational goal, that is to say, high educational aspirations. This result is also in line with Carroll's et al. (1999, 2001) aforementioned work showing that delinquent goals and educational goals seemed to be somehow opposite.

Hirschi also mentions that belief in the moral validity of conventional social norms is an important factor linked to antisocial behaviour. Conformity with school and society norms is related to the significance that adolescents give to the institutional order. Let us examine this idea more in depth following the argument by Emler and Reicher (1995, 2005). As these authors remark, formal education provides most children with their first direct experience of an institutional system of authority; given the time spent at school and its importance in their daily lives, one may expect that attitudes to teachers as formal figures and to school as a formal institution would be related to attitude to authority generally, and this has indeed been confirmed in several studies showing the strong correlation between attitudes towards teachers and attitudes towards the police and the law (see also Emler, Ohana, & Dickinson, 1990; Emler, Ohana, & Moscovici, 1987; Levy, 2001; Rubini & Palmonari, 1998).

Attitudes to both teachers and the police have been related in turn to misbehaviours in schools as well as to more general antisocial behavioural patterns in adolescence (Musitu, Estévez, & Emler, 2007; Loeber, 1996; Tarry & Emler, 2007). Furthermore, some studies with samples of secondary students measuring levels of antisocial behaviour and attitudes to teachers and police, have found attitude to teachers to be a stronger predictor in comparison to perception of police (e.g., Levy, 2001; Molpeceres, Llinares, & Bernad, 1999). In the research carried out by Molpeceres et al. (1999) teachers received the most negative scores in the general sample, and moreover these were more closely related to orientation towards transgression than were attitudes to formal authority as represented by police. What these authors concluded in their study is that the moral judgement of the teacher is a crucial aspect in the development of the general orientation to formal norm systems.

The general thesis reflected in these findings is related to the perceived functions of the institutional order, and was briefly exposed in the previous section. Students are expected to support the formal system and obey those who are formally authorized; in exchange they are offered protection and resources. However, as recently argued by Tarry and Emler (2007, p.172) “Cognitive change across childhood also supports a growing capacity to differentiate between the principles and the practice of formal authority. For some children this differentiation exposes a gap; in their experience such authority is neither impartially exercised nor does it offer them reliable protection against victimization”. When that happens, some adolescents take the decision to seek an alternative means of protection, an *informal* solution. In this sense, antisocial acts such as writing graffiti, thefts, or defiance of teachers could be translated into “I neither trust you nor have confidence in your help and protection. I both want to and am able to defend myself”.

CONCLUSIONS AND IMPLICATIONS

Both attitude to school context and reputation among peers are related to degree of behavioural adjustment at school. Individual differences in these variables contribute to the explanation of why some adolescents engage in antisocial behaviours and other do not. In general, adolescents who display negative attitudes to formal figures and institutions, such as teachers and the school context and who search for social recognition as non-conforming individuals, are more likely to develop behavioural adjustment problems. School environment and school experience are key factors in determining the desire for a particular reputation

among peers as well as attitudes in relation to the school as a formal institution. Thus, misbehaviours at school may be reflecting the need to establish a social identity and gain recognition while conveying a message of rejection of formal authority.

These findings have some relevant practical implications. First of all, it is important to highlight that interventions should not only focus on the particular individuals involved; this would be to overlook relevant contextual factors that need to be taken into consideration to understand and mitigate the problem. Intervention programs that improve family climate and relationships with parents, while improving commitment to school and attitudes to teachers and educational centres would be very useful. School-based prevention and intervention programs should consider several levels of intervention. For instance, numerous programs focused on changing the school and classroom environment as a whole have been proved to be effective in reducing behavioural adjustment problems in adolescence (a wide review can be found in Gottfredson, 2001).

Teachers' commitment to put into practice all these strategies is crucial, as is teacher training through short courses including an overview of the risk and protective factors related to behavioural adjustment in childhood and adolescence, as well as on how to handle conflict situations that might arise among students; many teachers would find this information very useful since sometimes they cannot do more than they already do simply because they do not have the suitable resources. Cooperative learning is also highly recommended in preference to competitive strategies in the classroom. Cooperative learning helps students to get to know each other, thus providing a step closer to reducing social integration problems among classmates and enhancing quality relationships and friendships. In cooperative tasks everybody makes a contribution in the activity, since the final result depends on the effort of each member in the team.

Together with these proposals, there are other concrete measures to be applied directly with students. As Gottfredson (2001, p. 226) remarks in her book *Schools and Delinquency* "school-based programs aimed at altering individual behaviours, skills, attitudes, or beliefs have been shown to reduce problem behaviour for all age groups and for both general populations and high-risk populations within each age group". This includes, among others, strategies for promotion of empathy and non-violent confrontation techniques, self-management and emotional control instruction, empowerment to students to seek and benefit from positive identities (instead of bad reputations), as well as enhancement of participation practices in a democratic environment in the classroom that enhance students' feelings of support and belonging. Setting up these practices would improve students' general attitude to the school context and would probably reduce unruly and antisocial behaviours.

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Chapter 11

**DYSLEXIA AS A SYNDROME:
DON'T LET 'READING DISABILITY'
STEAL THE SHOW**

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ABSTRACT

This chapter proposes a 'stipulative' definition of dyslexia, in which it emphasises that the phenomena of dyslexia constitute a syndrome. Some of the main characteristics of the syndrome are then described. They include lateness in learning to read, poor spelling, slowness in appreciating the significance of symbolic material, and other manifestations which will be described below. The condition often runs in families. It is argued that if dyslexia is defined simply as 'poor reading' or 'reading disability' there is risk that the many other manifestations of the syndrome, including the positive talents of dyslexics, will be overlooked.

INTRODUCTION

If people ask for a definition of dyslexia, the question needs further specification. Are they asking for a single formula which will encapsulate the essentials of dyslexia – much as one can encapsulate the essentials of a triangle by saying that it is a plane figure bounded by three straight lines? And is such a definition possible in the case of dyslexia? Is the request simply one for information on how the word is commonly used (so-called 'lexical' or 'dictionary' definition)? Alternatively there is the so-called 'persuasive' definition in which the user promotes a particular view of dyslexia and therefore offers what is called a 'stipulative' definition. (For further discussion of the concept of definition see Robinson, 1950).

In this chapter there will be a ‘persuasive’ and ‘stipulative’ definition of dyslexia; it will involve a commendation of the view that dyslexia should be regarded as a syndrome, not just as a reading disability.

The syndrome view is implicit, though not explicit, in the writings of the early pioneers (Hinshelwood, 1917; Orton, 1937-1989; Critchley, 1970).

Stipulative definitions may legitimately advocate small changes to dictionary definitions, but any major departure from normal usage runs the risk of being misleading, since if a word is being used in a new way it is not always easy to discount its previous associations.

Detailed documentation of the behavioural characteristics of dyslexics will be found in many publications, including Naidoo (1972), Thomson (1991); Miles (1993) and Miles (2006). Generalisations about dyslexia should be made only with caution. It is safe to say that many or even most dyslexics display certain characteristics, but it is virtually never true that they all do so. Inherent weaknesses can, of course, be compensated for by practice and special training; it is therefore dangerous to say in advance what a dyslexic can and cannot be achieve in particular circumstances.

Miles (1993) expressly speaks of a *pattern* of difficulties, and it is argued in Miles (2006) that classifying the phenomena of dyslexia as a syndrome provides a useful taxonomy or classificatory principle – one is able to make discoveries with it which one could not have made without it.

It has also been argued (Miles, 2006, chapter 22) that dyslexia is a disjunctive concept. This means that it sometimes manifests itself by symptoms, say, a, b, d, f, and i, sometimes by symptoms a, b, c, g and h. The manifestations are not identical in different individuals but those with appropriate experience can recognise similarities in the underlying pattern.

THE CHARACTERISTICS OF THE SYNDROME

That the phenomena of dyslexia have a constitutional basis is not in dispute, though much remains to be discovered (for some pioneering work in the area see Galaburda, 1989). The most likely explanation of the manifestations is that dyslexics have a deficiency in the area of *phonology* – that is, in the recall and ordering of speech sounds. (For references see, for instance, Beaton, 2004).

Characteristics of the syndrome include lateness in learning to read, poor spelling, difficulty over the retention of number facts, difficulties over the rapid absorption of symbolic material, problems over the recall of times and dates, problems over reading musical notation, and sometimes mispronunciations in spoken language (see Miles, 2006 for detailed evidence). (For evidence on the strengths and weaknesses of dyslexics at mathematics see Miles and Miles, 2004, and for evidence of their strengths and weaknesses at music, Miles and Westcombe, 2001; Miles, Westcombe and Ditchfield, 2008). An account of the many different influences on English spelling will be found in E.Miles, 2005).

It has also been possible to devise a test aimed at checking for the presence of some of the main features of the syndrome (Miles, 1997). Judgments that an individual is dyslexic are usually made on clinical grounds – that is, by combining and making sense of a variety of different observations. This test attempts to ‘operationalise’ these clinical judgments – that is, to specify those samples of behaviour which in conjunction add up to a diagnosis of dyslexia.

The test's scoring system takes into account such things as hesitations and requests for the question to be repeated, since in the appropriate context they may be clinically significant.

Emphasis has also been placed on recent years on the talents of dyslexics. Systematic evidence that they have distinctive talents not possessed by their non-dyslexic peers is hard to come by, but this possibility cannot be ruled out. (For evidence in this area see West, 1997). Certainly teachers, employers and the dyslexics themselves should be encouraged to 'think positive' and look for areas of strength, not limiting their attention to areas of weakness.

THE DEFINITION OF DYSLEXIA AS 'POOR READING' OR 'READING DISABILITY'

There are those who have recognised that the reading problems of dyslexics constitute a specific handicap; this has led some people to speak not just of poor reading but of 'reading disability'. A disability is something persistent and severe, requiring special measures for its treatment. That dyslexia in the syndrome sense is a disability is, indeed, clear, but it involves very much more than poor reading.

Suitable teaching programmes can make the reading problems largely disappear (for a description of some of these programs see Miles and Miles, 1999, chapter 12). Use of the 'poor reading' definition may encourage teachers to suppose that when the reading difficulties have been largely solved the teachers has done their job. By implication, therefore, someone else is left to solve the spelling problems. It is clearly more economical in time and effort if, by means of systematic teaching of letter-sound correspondences, reading and spelling are brought on together.

There is the further problem that when the child has been taught to read researchers were tempted to speak of 'compensated dyslexics'. This terminology encourages us to forget that dyslexia is a lifelong condition, its effects being liable to show themselves, perhaps unexpectedly, in new situations. Without the syndrome concept such things would be baffling and inexplicable.

Without it, too, the performance of dyslexics at mathematics and music is likely to be bewildering. Some dyslexics are capable of very advanced mathematical reasoning; yet most of them have incredible difficulty in memorising such basic things as 'times tables' – and they may well lose their way in adding up a column of figures. Without the syndrome concept teachers may be misled into thinking a dyslexic pupil is weak across the board and fail to notice what may be outstanding creative skills.

Similarly many dyslexics are extremely sensitive musicians, yet sight reading of musical notation may be extremely difficult for them

There are problems in remembering instructions ('Take the second on the right and then the first on the left'); there are difficulties in remembering to keep appointments and being on time for them. Many such mishaps affect the college student (Du Pre, Gilroy and Miles, 2007) and dyslexics are more vulnerable than their non-dyslexic peers in many social situations (Miles, 2004; 2008).

Above all, if we think of dyslexics simply as poor readers or disabled readers there will be no incentive to look for their talents. These talents, if not nurtured, will be lost to society – something high society can ill afford.

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