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Developmental Co-ordination Disorder in Preterm Children born ≤ 32 Weeks Gestational Age

by Foulder-Hughes LA, PhD, Med, DipCOT
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ABSTRACT

This study aimed to discover whether children who are born very preterm, ≤ 32 weeks gestational age, are at an increased risk of developmental co-ordination disorder (DCD), when compared to children born at full term. The preterm cohort consisted of children who were born in the Liverpool postal code region during 1991-1992, who were at mainstream school, followed up at age 7 or 8 years. Children were assessed alongside age, sex and classmate control children, who were born at full term ≥ 37 weeks. A total of 280 preterm subject children, and 210 controls were assessed. Motor function was assessed using the Movement ABC, (with the 5th %ile used as the cut off point to define DCD), the VMI to test visual motor integration function, and the WISC IIIR UK, to screen intelligence levels. There were highly significant statistical differences between the subject and control groups on all of the standardised assessments (p=<0.001). The incidence of DCD in the preterm group was 30.7% (n=86), compared to 6.7% (n=14) in the control population. Total, verbal and performance IQ results were lower in the preterm group (p=<0.001), however there was a correlation between poor fine motor skills, and problems with visual motor integration and performance IQ scores, and ultimately total IQ. Our research has demonstrated that preterm children are significantly more likely to develop DCD, and associated performance and intelligence difficulties, than children who were born at full term. These difficulties may ultimately affect school performance and activities of daily living, so further research is required into the benefits of suitable intervention.

INTRODUCTION

During the past two decades there were dramatic improvements, both technologically and therapeutically, in obstetric and neonatal care which led to improved survival for very low birthweight (VLBW :<1500g) and extremely low birthweight (ELBW :< 1000g) babies.
The rate of major motor or sensory disability, which is usually classified under the rubric term "cerebral palsy" is between five and eighteen percent (Volpe 1997, Sheth 1998, Emsley et al 1998). The remainder, of surviving babies, are free from major impairment and will eventually attend main stream school.

There has been much interest into the developmental outcome of such surviving preterm children. Previous VLBW and ELBW studies, indicate that approximately a third of these children will experience motor difficulties or “clumsiness”, (ie Roberts et al 1989, Levene et al 1992, Mutch et al 1992, Powls et al 1997).

Since 1992, the preferred term in describing "clumsiness" in children is DCD. Both the World Health Organisation (WHO 1992), and the American Psychiatric Association (APA 1994), have provided similar definitions recommending that the term DCD be used.

The WHO 1992 definition states that both fine and gross motor function should be significantly lower than the expected level on the basis of the child`s age and general intelligence. They recommend that this is best assessed on the basis of individually administered, fine and gross motor standardised tests. The second definition of DCD of the DSM 1V (APA 1994), also states that motor performance is substantially below that individual`s chronological age and measured intelligence. It further states that impaired motor function directly interferes with activities of daily living and academic achievement.

Many preterm studies have described high levels of fine motor dysfunction and problems with hand eye co-ordination (Roberts et al 1989, Levene et al 1992, Mutch et al 1992, Marlow et al 1993, Powls et al 1995, Goyen et al 1998, Jongmans et al 1998, Luoma et al 1998), which may interfere with academic achievement, despite intelligence levels being within the normal range (Powls 1997).

The papers reviewed suggest that approximately a third of these children have significant difficulties consistent with DCD. However, there have been huge variations in both the methodology and terminology employed by these researchers in describing motor dysfunction in this group. Much previous preterm research has also been prone to selection bias, with participants in these studies being recruited mainly by birth weight and not gestation, from single centre populations, or by not using age, and gender matched control children. Such studies are hence descriptive and not generalisable to the overall population of preterm children.

Also, very little is known about the prevalence of motor difficulties in survivors of modern neonatal intensive care, born during the early 1990s.
Prior to the introduction of serial ultra sound scanning during pregnancy, preterm babies were classified according to their weight at birth. This meant that heavier preterm babies who were above the 1500g limit, were a poorly studied group.

The present study describes the motor outcome in a geographically defined population of children born $\leq$ 32 weeks of gestational age in 1991-1992 followed up at age 7 or 8 years.
This is one of the first major follow up studies of a group of children who were the recipients of modern neonatal intensive care. As there have been few further technological or therapeutic improvements since the beginning of the 1990s, (when these children were born), they are likely to be representative of babies born preterm at the present time. The authors thus, hypothesised that there would be no statistical difference in the motor performance of surviving children who received improved neonatal treatment, when compared with full term, age and sex matched control children, at main stream school.

METHOD

SELECTION OF SUBJECTS

Following ethical approval, subject details were obtained from the birth registers at eight different hospitals within the Liverpool postal code region. These were the Liverpool Womens , Fazakereley , Ormskirk , Arrowe Park, the Countess of Chester, Warrington

General, Whiston, and Southport, and all of these hospitals covered the Liverpool postal code area. Children were selected if they had a Liverpool post code and were born at or below 32 weeks gestational age during the period from January 1991 - December 1992. .

A total of 382 babies fulfilled our criteria.
Out of a potential cohort of 382 children, it was found that 33 could not be traced, 18 had died , 29 were attending special school (4 of these children were attending mainstream school but were identified as having cerebral palsy), and 16 parents refused to provide permission for testing. This left a potential cohort of 286 children who were eligible to participate in the study.

APPROACHING PARENTS AND GUARDIANS
As stated in the research proposal and at the ethics committees, the initial contact with parents or guardians had to be made via the original paediatrician. The parent information pack clearly stated what the research was about, the overall aim of the study, who the researchers involved were and their role in the study. Written , informed, parental consent was then obtained.

TEST INSTRUMENTS

MOTOR FUNCTION
Both fine and gross motor skills were assessed using age band 2 of the Movement Assessment Battery for Children (Movement ABC) (Henderson and Sugden 1992). Age Band 2 is suitable for testing children aged 7 and 8. Age appropriate norms are given for this test.

The motor components of the test comprises of 8 items, divided into the following subsections, manual dexterity, ball skill, static and dynamic balance. The scoring system is from 0 -5 ranging from no impairment to severe impairment for each item.

The scores for each item are added together and then converted to percentile ranks. Between there 15%ile -5%ile is considered borderline, and ≤5%ile is indicative of very definite motor impairment. The current study used the 5%ile on the Movement ABC to define motor difficulties consistent with DCD.

SUBTLE MOTOR CO-ORDINATION DIFFICUTIES
More subtle motor difficulties were assessed by using the Clinical Observations of Motor Postural Skills (COMPS) (Wilson et al 1994). This test is closely related to tests of "soft " neurological signs and was not designed to measure one domain of motor performance; rather it appears to reflect cerebellar function, subtle motor co-ordination and postural stability. The COMPS can detect the presence of motor problems with a postural element. The test comprises of 6 items each with item scores from 0 -12. Item scores are then converted to total weighted scores ; < 0 suggests difficulties with motor postural skills. The six items which the COMPS is comprised of are, slow (ramp) movements, rapid forearm rotations (diadochokinesis), finger-nose touching, prone extension posture, asymmetrical tonic neck reflex (ATNR) and supine flexion posture. It is also useful to use the scores of individual items to assess whether specific areas of difficulty exist, for example, a score <12 on the ATNR item would suggest that this reflex has not been fully inhibited.

VISUAL MOTOR INTEGRATION

This function was measured using the Developmental Test of Visual-Motor Integration (VMI) (Beery 1997).This test consists of 27 geometric forms which increase in complexity, and are developmental in sequence. .

The VMI is a valid and reliable tool to assess the integration of both visual and motor abilities.

There is a one point scoring system for each of the geometric shapes which are then converted to age appropriate standard scores. Standard scores have a mean of 100 and a standard deviation of 15.

INTELLIGENCE

General intelligence was measured using the Wechsler Intelligence Scale for Children UK (WISC III UK). Total, verbal and performance IQ scores were calculated and expressed as standardised scores with a mean of 100 and a standard deviation of 15.

DATA ANALYIS

The children`s test results were scored manually in accordance with each test publisher`s instructions. The final data was then either entered directly or coded as a numerical variable and entered on to a data base using SPSS (statistical package for the social sciences) version 8 for Windows. Statistical analysis was carried out using SPSS, statistical significance level was p=0.05, using both parametric and non parametric tests depending upon the type and distribution of the data.

RESULTS

A total of 490 children were assessed. The group consisted of 280 preterm children and 210 full term age and sex matched, participant children. Six children did not have the motor tasks administered due to time constraints. The preterm cohort was comprised of 151 (53.9%) males, and 129 (46.1%) females; the full term group consisted of 112 (53.3%) males and 98 (46.7%) females. Table 1 summarises the profile data of the preterm cohort. The mean age at testing was 89.8 months (range 82-101) for the preterm children and 89.9 (range 72-107) for the full term children.

MOTOR TESTS

There were highly statistically significant differences between the preterm and full term groups. The full term cohort scored consistently better than their preterm class mates on all of the measures of motor function.

Movement ABC

The Movement ABC was the primary outcome measure of motor function. The total median score for the full term group was 8.5 (mean= 11.47), however, the full term children scored considerably better with a median score of 3.5 (mean= 4.8), which was highly significant at p=<0.001 level (Mann-Whitney U). Table 2 displays the median and mean values from the individual sub-sections for both groups..

Using the 5th %ile on the Movement ABC to indicate possible DCD, we found that 86 (30.7%) of the preterm group, fulfilled this criteria, compared with just 14 (6.7%) of the full term cohort. We did not find any significant differences for DCD between the sexes. In the preterm cohort 42 boys (27%) and 44 girls (34%) had definite motor difficulties (p=0.220),

whilst in the fullterm group it was 9 boys (8%) versus 5 girls (5%), (p=0.243), all values Chi 2 .

The Spearman rho correlation coefficient between the Movement ABC score and gestational age was -.190 (p=.001), and between the ABC score and birthweight was -.176 (p=.003). This trend suggests that older gestational age children and those who were heavier at birth perform better on the Movement ABC.
To establish whether having an early gestational age or a lighter birthweight would place younger and smaller babies at risk of long term DCD a Chi 2 test was applied to recoded categorical data. There was however,very little evidence to suggest that earlier gestational age (≤ 28 weeks, p=0.239), or VLBW (p=0.056), was strongly associated with DCD.

RELATION TO COMPS

Of the preterm group 227 children were assessed with the COMPS, and 176 of the full term group.
A total of 97 (38.8%) of the preterm cohort, and 18 (10.8%0 of the full term group displayed subtle motor co-ordination difficulties with total weighted scores <0; this finding was highly sinificant p=0.001 (Man- Whitney U).
In the preterm DCD group 74 also had COMPS screening, compared with 9 children from the fullterm DCD cohort. Using the 5th%ile of the Movement ABC to represent DCD, and scores < 12 on the ATNR subsection of the COMPS to represent a positive ATNR with flexion >30 degrees at the elbow, we found that persistent ATNR was found to be associated with DCD. In the preterm DCD group 54 children displayed a positive ATNR with a 73% predictive power to detect DCD (p=<0.001). Whilst in the full term DCD group 6 were found to have persistent ATNR, with a 66.6% power to detect DCD (p=<0.001 Chi 2 with Yates`correction).

RELATION TO COGNITIVE MEASURES

The preterm group scored considerably worse than the full term children on total IQ, performance IQ, and verbal IQ measures, in addition to poorer VMI scores (all p values <0.001 independent sample t-test). Table 4 displays the results of the cognitive and VMI measures. On the intelligence tests it would appear that it was both Total IQ scores and Performance IQ scores that were strongly influenced by poorer scores on the VMI and the fine motor items of the Movement ABC in the preterm group. The Spearman`s rho correlation coefficient between total IQ and: VMI standard score was .44, ABC flower trail was -.37, ABC placing pegs was -.36, and for threading lace it was -.32, (all p values <0.001). There was a very strong correlation between total IQ and performance IQ with the rho correlation coefficient being .83 (p=<0.001). The Spearman rho correlation coefficient between Performance IQ and : the VMI was .52, ABC flower trail was- .34, ABC placing pegs was - .45, and threading lace -.38, (all p values <0.001).

Table 1: Profile of Preterm Cohort.

Preterm subjects n=280

Mean gestational age in weeks (range)	29.8 (23-32)
% of cohort ≤ 28 weeks (n)	21.4 60

% of cohort ≤ 24 weeks **(n)**	3.6 10
Mean birth weight in grams **(range)**	1467 (512-2860)
% of cohort <1500g **(n)**	50.4 138
% of cohort <1000g **(n)**	14.6 38
singleton birth (n)	215
twin birth (n)	56
triplet (n)	**9**

Table 2 Movement ABC Median Sub-section Impairment scores

Median scores	**Preterm Cohort** n = 280	**full term cohort** n = 210	*** p value**
ball skills:			
bean bag	1 (1.7)	0 (1)	<0.001
bounce and catch	1 (1.6)	0 (0.8)	<0.001
Fine motor			
flower trail	1 (1.3)	0 (0.6)	<0.001
placing pegs	1 (1.3)	0 (0.6)	<0.001
threading lace	0 (1.5)	0 (0.8)	<0.001
Static balance			
stork balance	1 (1.5)	0 (0.5)	<0.001
Dynamic balance			
heel to toe walking	0 (1.1)	0 (0.1)	<0.001
jumping in squares	0 (0.87)	0 (0.6)	<0.001

*** Mann-Whitney U test**
(all values in brackets are means)

Table 3 COMPS Sub-Sections.

COMPS SUBSECTION

	Pre term	**Full term**	*** p value**
MEDIAN SCORES **(mean)**	n = 227	n = 176	

ATNR	12 (9.3)	12 (11.4)	<0.001
finger – nose touching	8 (7.8)	12 (10.2)	<0.001
prone extension	8 (6.8)	10 (9)	<0.001
forearm rotations	12 (10.3)	12 (11.5)	<0.001
slow motion	12 (10.4)	12 (11.6)	<0.001
supine flexion	8 (7.8)	10 (9.7)	<0.001
TOTAL WEIGHTED SCORE	**0.95**	**1.89**	**<0.001**

*** p values from Mann-Whitney U analyses. Values inbrackets expressed as means.**

Table 4 Intelligence tests and VMI

	Pre term cohort n = 280	**Full term n = 210**	**Difference (95% CI)**	**p value**
VMI Mean (SD) IQR %<70 % <85	90.5 (9.2) 85 – 97 1.8 24.3	96.9 (7.8) 92 – 102 0 8.1	6.4 (-7.97 – 4.84)	<0.001
Verbal I.Q Mean (SD) IQR %<70 %<85	92.9(13.9) 83 – 102 4.9 27.9	101.2 912.7) 92 – 108 0.5 10	8.3 (-10.7 – 5.7)	<0.001
Total I.Q Mean (SD) IQR %<70 %<85	89.4 (14.2) 80 – 99 8.7 35.5	100.5 (13.7) 91 – 109 1 12.2	11.1 (-13.7 –8.5)	<0.001
Performance I.Q Mean (SD) IQR %<70 %<85	87.8 (15.6) 77 – 98 12.8 43.4	99.6 (15.8) 88 – 110 2.5 17.8	11.8 (-14.7 – 8.9)	<0.001

All p values are from independent sample t test

DISCUSSION

The cohort of preterm children in this study are unique for a number of reasons. Firstly, many previous studies have selected children on birth weight rather than gestation. This excluded heavier preterm children with lower gestational ages, and included higher gestation children with a lighter birth weight. This led to almost half of the group weighing more than 1500g,the limit, employed by the many of previous studies, (ie: Levene et al 1992, Marlow et al 1993, Powls et al 1995).

The preterm subjects scored considerably worse than their full term peers across the range of the motor tasks. The rate of DCD accounted for a third of the group, which is consistent with the previous work, (ie Mutch et al 1992, Marlow et al 1993, Powls et al 1995, Jongmans et al 1998). This was an interesting finding as we had used gestation and not birthweight to define prematurity, yet the rate of impairment remained the same. We did find a correlation between birth weight, gestational age and performance on the Movement ABC. This could have been partially influenced by the group consisting of a higher number of older gestational aged children who were born after twenty eight weeks and an overall increased birthweight. When we analysed the data further and investigated the DCD group, who had scored at or below the fifth percentile on the ABC, we could not find evidence to suggest that younger gestational age infants or those with lower birth weights are more at risk of DCD. In fact neither were shown to adversely affect later motor outcome, as this group consisted of children who were born both before and after twenty eight weeks, those who had weighed both above and below the 1500g limit.

Consistent with earlier work, (ie Powls 1997, Jongmans et al 1998), the subjects in this research displayed a high incidence of fine motor impairment. The results were statistically significant on all of the manual dexterity items on the Movement ABC, on the VMI, the also displayed difficulty with eye hand coordination, together with visual motor integration. We found that although this group of preterm children did have lower mean IQs than the full term cohort, they were still within the normal range. In fact their interquartile ranges were normal, and their verbal IQs were considerably higher than both their total IQ and performance IQ scores. We also demonstrated that having significant fine motor impairment is likely to adversely affect scores on the performance IQ, which in turn will contribute to an overall lower total IQ score. The findings are extremely important, not merely in replicating the findings of previous work of preterm children, but also because of the potential functional implications that fine motor dysfunction has on very day life. For example, there has been a number of studies which suggest that these children are far more likely to be experiencing difficulties with school work, despite having IQs within the normal range (ie Roberts et al 1989, Powls 1997). The majority of academic work focuses on results gained from having normal fine motor function, for example written work, copying, drawing etc. The tests used to examine fine motor skills in the present study, address a wide range tasks which are commensurate with a child`s understanding and level of intelligence, yet these are also activities which can be generalised to work at school. The cohort which was examined by Powls (1997), at age 12 and 13, were also examined in early childhood by Roberts et al (1989). They found, that those children who were experiencing fine motor difficulties in both age groups, were also likely to be experiencing academic difficulties later in school. It is therefore not surprising to find that so many preterm children are likely to experience school achievement problems when compared to their full term peers, when they are displaying a high incidence of fine motor dysfunction, it may further be suggested that the two are inextricably linked.

Other studies have shown differences in motor outcome between the sexes. Most suggest that males perform less well than females, (Elliman et al 1991, Hall et al 1995, Jongmans et al 1998), and one study which found that it was the girls who were more impaired (Powls et al 1995). In this study we found that the incidence of DCD is likely to affect the sexes equally in both preterm and full term children and that sex can not be used as a predictor of motor difficulties.

There were also great differences for visual motor integration between the subjects and controls on the VMI. Our findings are almost identical to those that were was found by Goyen et al (1998) in their group of VLBW children, and Luoma et al (1998) in their group of pre term children born below 32 weeks gestation . Similarly in their pre term cohorts, Goyen et al (1998), Jongmans et al (1998) and Luoma et al (1998), demonstrated a definite correlation between impaired VMI scores and motor difficulties. The VMI scores are obtained by correctly copying a series of geometric shapes, and is highly dependent on adequate pencil control, with eye hand co-ordination, which is what is required on the flower trail item. Since there was such a high incidence of motor difficulties, it may be that this pre term group are more likely to have impaired VMI scores due to their fine motor problems. In addition, these children are more likely to have problems with persistent ATNR which will affect the postural stability, whilst completing the VMI and other fine motor items.

Indeed, the continued presence of the ATNR was found to be strongly associated with impaired motor performance in both the subject and control populations. As early as 1964 the ATNR was found to be a diagnostically useful tool in identifying children with "spasticity or dyskinesis" (Paine 1964).

Although it was persistent in the control population, the degree to which it is was present was not as great as that of the subjects. De Gangi (1994) suggests that an active ATNR will interfere with fine motor skills such as hand-eye co-ordination, and in maintaining eye contact during motor activities, such as ball skills. She also reports that balance can be significantly disrupted due to decreased trunk rotation and disassociation of the body and neck.

It has been suggested that until the ATNR is fully inhibited then children may have difficulty in holding the head in midline, and indeed conducting activities which require "crossing" the midline (De Gangi 1994). This would significantly affect a childs` ability to sit and complete the VMI test, as the completion of the task means copying shapes across a work book, which is dependent on crossing the mid line of the body. As the VMI test is related to hand writing, it would appear that in a class room setting that the children with active ATNR may also be those children who experience writing difficulties.

However, the ATNR was present in some of the full term control children, and there are several possible explanations for this. It is accepted that the ATNR should be inhibited by around six months old, in normal development, but there is very little published literature available on full term children beyond this age. Indeed after the six week developmental check this reflex is not routinely screened for by most paediatricians. Parmenter (1983), who developed the rating scale for the ATNR from which the COMPS item was developed, suggests that the persistence of this reflex beyond thirty degrees of flexion at the elbow, is indicative of central nervous system immaturity, and that it should be completely inhibited by eight years old. Further research should be conducted, beyond the routine developmental check at six weeks, (corrected age), so that a greater understanding is gained into what a normal course of development is in relation to this primitive reflex.

The present research has clearly demonstrated that preterm children, who are at mainstream school, are significantly more likely to experience motor difficulties consistent with DCD when compared to their full term classmates.

Future work should focus on the early motor developmental history of preterm children, in an attempt to establish whether their movement difficulties are secondary to a lack of motor experience, or whether they can be attributed to more cognitive means (ie difficulties in motor planning rather than co-ordination).

We have demonstrated a link between poor performance and total IQ scores with an excess of fine motor difficulties, which in turn may affect a child`s overall academic achievement. As greater numbers of preterm children now survive and enter main stream school they should be offered evidence based intervention at an early stage in order to ameliorate later motor problems and possible subsequent poor school performance. Therefore, there is not merely the scientific justification for further research into the area of intervention, but also an ethical and moral obligation to do so.

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Differences Between Dyspraxics and Dyslexics in Sequence Learning and Working Memory

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Abstract
This study investigated differences and similarities between dyslexics and dyspraxics in terms of hypothesised problems with sequence learning. Adult dyslexics (11), dyspraxics (10) and controls (23) participated. The ages of the participants ranged from 16 to 66 (mean 28), and 25% were male. Initial tasks confirmed difficulties in language and co-ordination areas. Sequencing tasks assessed immediate recall of audio and visual, spatial and visual-spatial stimulus requiring verbal and motor responses. Dyspraxics recall was poor on visual, spatial and visual-spatial tasks with motor responses, dyslexics doing best on these tasks. However, dyslexics performed worse on the auditory/verbal task, again in constrast to dyspraxics. Phonological and visual-spatial difficulties appeared to affect performance in sequence tasks, suggesting that the parallel rehearsal subsystems of working memory may be impaired accordingly. Findings are discussed in terms of their implications for assessment and remediation.

Introduction

Individuals with the specific learning difficulties (SpLD) of dyslexia and dyspraxia (also known as Developmental Co-ordination Disorder (DCD)) are known to have difficulties with learning sequenced information. Such information is important when acquiring complex life skills such as literacy, numeracy and organizational skills. Sequencing difficulties, in turn, have been linked to working memory deficits and both dyslexics and dyspraxics are known to have problems with short-term memory (Colley, 2000; Portwood, 1999; Dighe & Kettles, 1996; McLoughlin, Fitzgibbon, & Young, 1994). The Working Memory model (Baddeley & Hitch, 1974) proposes that short-term memory tasks involve phonological and visual-spatial subsystems controlled and organised by a central executive attention-like system. Baddeley & Logie (1999) argue that recall of the information required to learn and complete complex sequences is achieved by the interaction of the storage and rehearsal processes of these working memory subsystems.

Dyslexics and dyspraxics present a variety of different symptoms, for example dyslexics have trouble with reading and spelling and dyspraxics with co-ordination. Cognitive deficits in phonological and visual-spatial and motor abilities respectively are said to account for the respective problems. These appear to reflect the activities of the active rehearsal mechanisms found in the working memory subsystems: the phonological loop and the inner scribe (Baddeley & Logie, 1999). Although there are some overlaps between group symptoms, categorisation of individuals with SpLD tends to be in terms of dyslexia only, with dyspraxia often being enveloped in the assessment, possibly because it is easier for schools and colleges to get funding to support dyslexic students. Evidence that indicates differences between these

groups in terms of factors related to learning and skills acquisition would suggest the need to differentiate between these groups in order to provide appropriate support.

Dyslexia

Dyslexia has a variety of definitions and theories for underlying causes. The Dyslexia Institute (1999), which supports research and teaching for dyslexics, defines it as "… a specific learning difficulty that hinders the learning of literacy skills. This problem with managing verbal codes in memory is neurologically based and tends to run in families" (p.1). Such short-term auditory memory problems have been said to be related to an underlying problem with coding or processing of phonological or sound based information (Snowling, 1987). Miles (1993) suggests that the verbal memory problems of dyslexics may be due to their inability to quickly access 'verbal labels,' which will affect transfer from short to long term memory storage (p.20). Assessing memory capacity using digit span tests is one of the diagnostic assessment criteria for dyslexia (Rack, 1997). McLoughlin et al (1994) propose that all the typical characteristics of dyslexia may be due to a specific memory deficit and they note that, as well as pure phonological problems, the dyslexic person also has trouble with organising themselves and concentrating due to an inefficient working memory. However, Rayner & Pollatsek (1989) question whether developmental dyslexia is just due to short-term memory problems and they, consistent with Rack (1997), appear to prefer a definition of dyslexia that includes broader subtypes of dyslexics. Rack (1997) found that a third of dyslexic subjects in his study were subtypes who had visual motor co-ordination deficiency, half of whom also had memory and phonological problems.

There have been suggestions that dyslexics have excellent visual-spatial abilities due to the disproportionate number of dyslexics found in mathematical and architectural fields (The Dyslexia Institute, 1999). Despite this view, Winner, von Karolyi, Malinsky, French, Seliger, Ross & Weber (2001) argue that the neurological research that has assessed the view that dyslexics have above average visual-spatial abilities is equivocal. The results of their spatial ability tests given to three groups of dyslexics did not show any superior ability amongst the dyslexics. Winner et al argue that it could be that dyslexics perform better in spatial tasks simply because they are very poor on verbal tasks, and there is a debate over whether dyslexics enter careers that avoid phonological skills as a form of compensation. Indeed, some visual-spatial dyslexics have been found to have visual perception weaknesses or spatial and occulo-motor dysfunctions (Everatt, 1999; Willows, Kruk & Corcos, 1993).

Dyspraxia

Although dyslexics are the most widely noticed and examined group of children at school, children who show a lack of motor co-ordination and competence have, more recently, received attention because of the emphasis on such abilities within the school curriculum (Dighe & Kettles, 1996). Orton (1937, in Dighe & Kettles, 1996) suggested such difficulties were due to a neurological problem with motor planning, as well as difficulties due to inadequate visual-spatial cognitive abilities. In the 1980's, people with such problems were differentiated from amongst the population and dyspraxia was identified as an SpLD (Dighe & Kettles, 1996). Developmental dyspraxia has recently been defined as a "delay or disorder of the planning and/or execution of complex movements… Associated with this may be problems of language, perception and thought" (Colley, 2000, p.10). Dyspraxia is thought to affect ten percent of the UK population and, like dyslexia, effects more boys than girls (Colley, 2000).

Dyspraxics are said to have perception difficulties that result from sensory input misunderstandings. This gives rise to problems with 'co-ordination and listening skills, poor visual and auditory perception, lack of spatial and directional awareness and poor perception of self within the environment' (Dighe & Kettles, 1996, p. 238). Like dyslexics, dyspraxics are said to have poor memory and short attention span, and are especially slow in recalling information in stressful situations (Portwood, 1999). Dyspraxic children and adults have problems that include complex motor skills involving sequences of movements and their gross motor skills are late developing. They also have difficulty in learning and are 'awkward' with fine motor skills (Dighe & Kettles, 1996). Constructional praxis, hand-eye co-ordination and concentration are also particularly difficult (Colley, 2000; Miller, 1986).

Although a significant proportion of dyslexic children have been found to have motor-related difficulties (see Nicolson & Fawcett, 1995), not all children who have dyspraxia have dyslexic type learning difficulties (Stephenson & Fairgrieve, 1996). Yet many dyspraxics find their reading and numeracy can be affected by their difficulties with poor visual memory and perception, poor visual-spatial differentiation and sequencing problems. These deficits can make it hard to work out letter and number placing, shapes and order which can result in early language problems, delaying speech and affecting learning to read and spell (Colley, 2000). Hence, visual-related deficits may be accompanied by language-related problems. Sequencing in visual-motor and auditory-verbal tasks may be equally poor.

Sequence Learning

Learning a succession of items in the correct order is something dyslexics and dyspraxics are known to find difficult. Sequencing problems in dyslexic children affect auditory sequencing such as descriptive sentences, learning the alphabet and sequences of days and weeks. Spelling can also be weak since it is a sequential process linked to phonological and auditory skills (Snowling, 1987). Also affected are dyslexics' visual-motor abilities such as sorting beads by shapes, dressing, turning taps on and off, telling left from right, and doing jigsaws (Nicolson & Fawcett, 1995; Ott, 1997). Twenty percent of dyslexics are weak on times tables learning (Miles, 1993) and they have problems in timing of motor sequences (Wolff & Cohen, 1984). Plaza & Guitton's (1997) case study of a severe dyslexic indicated that average intellectual development can be accompanied by problems with visual and auditory sequencing.

Dyspraxics have been found to experience similar difficulties. They have problems repeating series of digits forwards or backwards and are poor at recalling the correct order of verbal instructions (Portwood, 1999). Complex tasks, which consist of components that have to be completed in the right order, cause dyspraxics the most problems during normal life and sequencing problems also cause them difficulties in numeracy, recall of number patterns and putting written work in the correct order. Dyspraxics require outline plans and direction to help them organize and order their thoughts (Dighe & Kettles, 1996).

Working Memory

McLoughlin et al (1994) note that although adult dyslexics can become good at reading and writing, and can overcome some of their problems, they will still have underlying difficulties due to the 'direct and indirect result of inefficiency in working memory' (p.17). Working memory has been found to be important for learning, as shown by the case of PV who had a severe deficit of verbal short-term memory that prevented long-term learning of phonological information (Baddeley, Papagno & Vallar, 1988). Similarly, Gathercole and Baddeley (1993)

discuss the importance of working memory processes specifically for language and literacy acquisition.

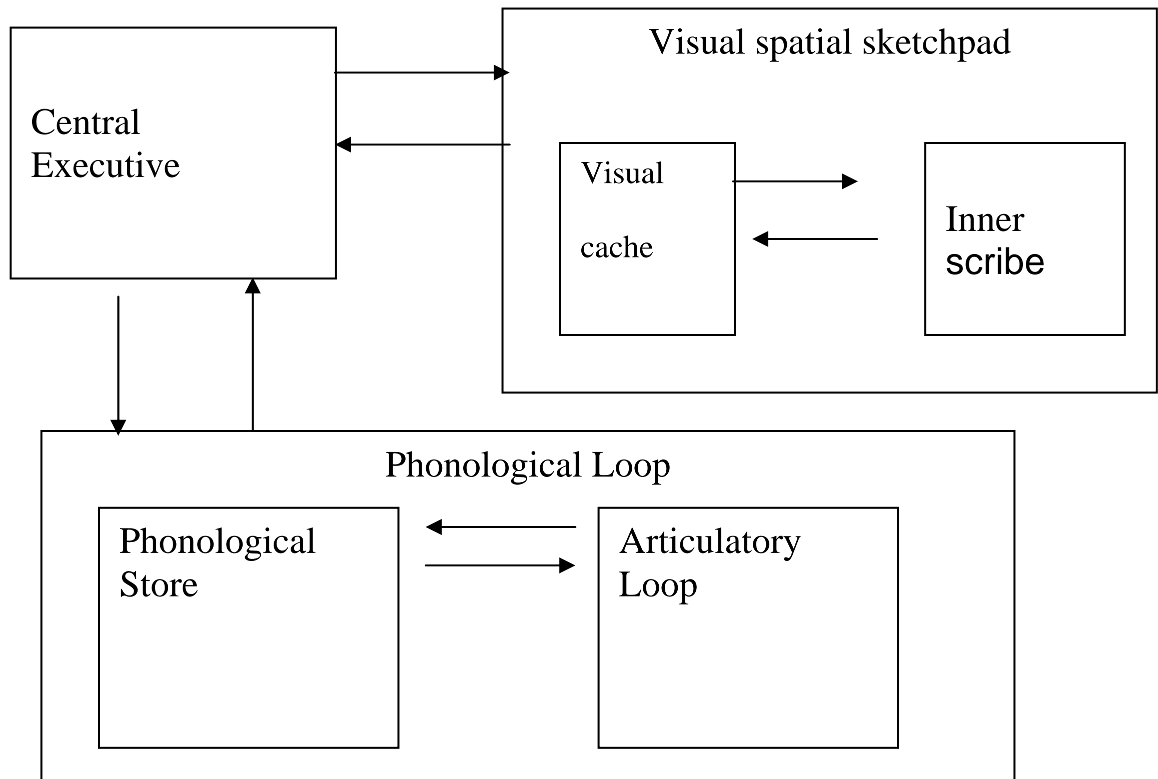


Figure 1. A diagrammatic representation of working memory, adapted from Baddeley & Logie (1999).

Baddeley & Logie (1999) describe working memory (see Figure 1) as comprising the central executive which controls and regulates two specialised subsystems, the phonological loop, which temporarily stores sound based input, and the visuo-spatial sketchpad, which temporarily stores visual and spatial input. The phonological loop is divided into a passive phonological store and an active rehearsal system (the articulatory loop), and the visuo-spatial sketchpad is separated into a passive visual cache and an active spatially based rehearsal system (the inner scribe).

Articulatory loop rehearsal within the phonological memory system is involved when sequences or lists have to be recalled immediately. A person's ability to recall information is tested by tasks in which they are asked to repeat back increasingly long series of numbers in the same order that they were presented. A measure of memory span is based on how many items or digits can be recalled in one series without any mistakes. Digit span measures are often used as part of SpLD assessment procedures (see discussion in Everatt, McNamara, Groeger & Bradshaw, 1999). In contrast to digit span measures, Smyth & Scholey (1994) found highest interference of spatial span recall during dual-tasks with motor responses. This suggests that spatial and motor functions are situated in the visuo-spatial rather than the phonological sub-system. Baddeley & Logie (1999) regard such immediate recall as a result of the interaction of the storage and rehearsal processes and assume that the activation of this interaction is vital to working memory. However, as active rehearsal only enhances memory, it has been said to be an optional feature as working memory will function without active

rehearsal, although it will be better with it. This may be of particular importance for learning disabled individuals. When given rehearsal training, learning disabled people with poor short term memory were found to have increased their memory span suggesting that repeated memory testing improved the use and effectiveness of the articulatory loop (Hulme & Mackenzie, 1992). Similarly, Hulme & Mackenzie (1992) found that children with learning difficulties and poor short-term memory found it helpful to learn the alphabet by tracing letters with fingers whilst saying the letters. Such multi-sensory procedures have been highlighted as successful in remediation. Learning procedures that make possible the use of all the five senses have been suggested as useful since specific deficits in one area might be compensated by using others. For example, dyslexics have been found to improve in memory and learning when using multi-sensory procedures (McLoughlin et al, 1994).

The current research

Despite potential relationships between SpLD and short-term memory processes, which may be important for assessment and remediation, further research is necessary. This is needed to explain the inconsistent findings for the relationship between dyslexia and sequence learning (see review in Everatt et al, 1999) that may mean that the relationship is unreliable. Alternatively, such variations could be due to combining different sub-groups of SpLD under the dyslexia label (see Rack, 1997). The present study, therefore, investigated performance on the same sequencing tasks by participants designated as dyslexic and those assessed as dyspraxic. The results were compared to a control group without SpLD to examine differences between the groups. Tasks comprised those that required phonological processing (auditory-verbal areas) and those that focused on visual-spatial processing (visual-motor areas). This allowed a comparison of SpLD sub-groups in tasks that targeted different sub-systems of the working memory model.

In order that individuals could be assigned to appropriate groups, participants were assessed on measures related to primary dyspraxic difficulties and factors related to dyslexia. These measures were taken from the established literature on both SpLDs and standardised assessment procedures. Tasks assessed fine motor control, visual-spatial skills, mental manipulation and psychomotor performance, phonological processing and literacy.

Methodology

Participants

Individuals with SpLD were recruited via a tertiary education Learning Support Department and an Adult Support Group within the South East of England. Control participants were accessed from the same populations: higher education students and members of the general public. Selection procedures ensured that SpLD and control groups were similar, as far as possible, in terms of age and male-to-female ratio (see Table 1) and had obtained similar levels of education. Details regarding level of education, any assessment of learning difficulty and demographic details, including the use of English-as-an-additional-language, were requested from the participant following testing using a standard interview questionnaire. The assessor recorded the individual's spoken responses on the personal score sheet to allow matching with test data.

Initially, 53 participants were tested; however, 9 controls were rejected from the final analyses due to four having English as a second language and five presenting evidence of SpLD on two of the screening measures. These measures were the spelling test and nonsense word reading task taken from the Dyslexia Adult Screening Test (Fawcett & Nicolson, 1998). The spelling test involved correctly spelling a list of 32 regular and irregular words in 2 minutes. The

nonsense word task required participants to correctly read out the words in a passage which contained 15 pronounceable letter strings that were not in the English language. The five controls removed from the analyses produced scores on one of these tasks that fell below the norms for their age groups and put them in the 'at risk' of dyslexia category.

The additional screening measures were:

(i) the bead threading task taken from the Dyslexia Screening Test, which required the threading of as many beads as possible out of a maximum of 14 onto a lace in 30 seconds;

(ii) the Spoonerisms task, based on the Phonological Assessment Battery (Frederickson, Frith & Reason, 1996), involved participants providing the first sound of a list of 7 spoken words and correctly swapping the first sounds of a list of 7 pairs of spoken words;

(iii) the Block Design sub-test of the Wechsler Adult Intelligence Scale (Wechsler, 1981), in which participants had to correctly reproduce a total of ten 2D designs using 3D blocks in 60 seconds (4 blocks for items 1 to 6) and 120 seconds (9 blocks for items 7 to 10) – the maximum score was 10;

(iv) the Digit Symbol sub-test of the Wechsler Adult Intelligence Scale (Wechsler, 1981), in which symbols and digits were paired and participants were given two minutes to correctly produce as many symbols next to a random list of corresponding digit (maximum 90 items). Group scores on these screening measures can be found in Table 2.

Table 1. Participants' demographic details by group.

Details	Dyslexic group	Dyspraxic group	Control group
No. of participants	**11**	**10**	**23**
No. of males	**3 (27%)**	**3 (30%)**	**5 (22%)**
No. of females	**8 (73%)**	**7 (70%)**	**18 (78%)**
Age range	**19 to 66**	**16 to 56**	**18 to 54**
Mean age	**27**	**33**	**28**

The final groups consisted of 11 dyspraxic, 10 dyslexic and 23 control participants. Table 1 shows that the ratio of males to females was comparable across the groups, despite presenting an atypical profile of incidence of SpLD amongst males and females; ie, more females than males. The main reason for this was the targeting of higher education students for assessment, since they provided a reliable source of diagnosed individuals, and the higher incidence of females taking the courses where selection occurred. Similarly, the support group where recruiting took place also included a high proportion of females. These figures should, therefore, not be considered indicative of the incidence of these SpLDs in the general population. Additionally, groups differed slightly in terms of age. However, analyses that controlled for such group differences (ie, including age as a covariate in analyses of covariance) produce the same conclusions as those presented in the results section.

Table 2 shows the results of each of the groups on the screening measures. Consistent with the categorisation of participants, the SpLD groups performed worse on the spelling and nonsense passage reading tasks. Dyslexics also showed particular problems in the phonological processing task of Spoonerisms and lower scores than the controls on the Digit Symbol task. Dyspraxics also performed poorly on the Digit Symbol task as well as the bead threading and Block Design tasks. These results confirmed the phonological-related deficits

indicative of dyslexia and the motor co-ordination problems that have been associated with dyspraxia.

Table 2. Average scores (with standard deviations in brackets) of each of the three groups in the screening tasks.

	Dyslexic	**Dyspraxic**	**No SpLD**
Bead threading	10.27 (1.85)	9.20 (1.87)	10.70 (1.36)
Digit Symbol	44.00 (11.38)	33.70 (7.51)	48.35 (9.36)
Block Design	9.45 (0.82)	7.90 (0.99)	9.13 (1.14)
Spoonerisms	10.91 (2.26)	12.10 (1.91)	12.00 (2.30)
Nonsense passage reading	11.64 (2.87)	11.40 (2.84)	12.78 (1.70)
Spelling	25.73 (3.10)	26.10 (6.01)	29.39 (2.37)

Task materials and apparatus

The test battery took approximately 30 minutes to complete and was conducted in a quiet room with no distractions. The experimenter sat adjacent to the participant for each test but without allowing the participant to see recording forms or test materials that were not in use at a particular point in time. Scores were recorded on each task sheet and transferred to the personal sheet when the participant had left. To attempt to avoid fatigue or learning effects, tasks were presented in random order. Pilot Tests were conducted prior to the data reported in this paper in order to establish any problems with the design of the tasks and the procedures implemented.

Each sequence task comprised the same basic procedure. Sequences varied only in terms of whether the sequence required the recall of verbal or visual/spatial material or spoken or pointing responses. Tasks involved giving participants a sequence of audio, visual, spatial and visual/spatial stimuli in the form of digits, digit cards, shape cards and draughts and shape cards placed randomly onto a blue sheet. Participants were requested to recall the presented sequence in correct order. Verbal and motor responses were recorded and the score was taken as the number of sequences correctly recalled in order. In each task, sequences started with three items and incremented by one after a correct answer at a particular sequence length. There were two sequences given at each sequence length. A total of 12 sequences were available. Two wrong answers at a particular length led to the task being discontinued and total score noted. Practice items and demonstrations involving sequences of two items were used for each task to ensure that the participant was fully aware of what was required of them.

The auditory/verbal sequence task involved a tape recording of sequences of spoken digits. These were played to the participant who was required to repeat the digits heard in the correct order when the tester paused the tape. The visual/verbal sequence task comprised 64mm x 86mm cards with digits printed on them in 72 font Times New Roman. Sequences of digit cards were separated by blank cards. Cards were placed on the table in front of the participant who was expected to verbally repeat the digits in the correct order when a blank card appeared. The spatial/motor sequencing task involved an A4 sheet of blue paper with rounded corners being placed in front of the participant. This contained a set of identical counters positioned at various locations around the sheet. Positioning reduced the likelihood of verbal labelling of positions. The assessor pointed at a number of the counters in a

sequence that the participant was required to repeat once the pointing movements for a particular sequence were completed. The number of pointing movements increased by one every two sequences, consistent with the increases in the digit sequence tasks. A visual/motor sequencing task involved sequences of cards containing distinct shapes being placed in front of the participant, one on top of the other. Sequences of shapes were separated by blank cards. When the sequence was complete, a card showing each of the nine possible shapes was shown to the participant who had to point out which cards they had previously seen in the correct order. A visuo-spatial/motor sequencing task comprised the same shapes as in the previous task, which were placed at different spatial locations over the same sheet as used in the spatial/motor task. Again, the participant pointed at the items in the order in which had been pointed at by the tester.

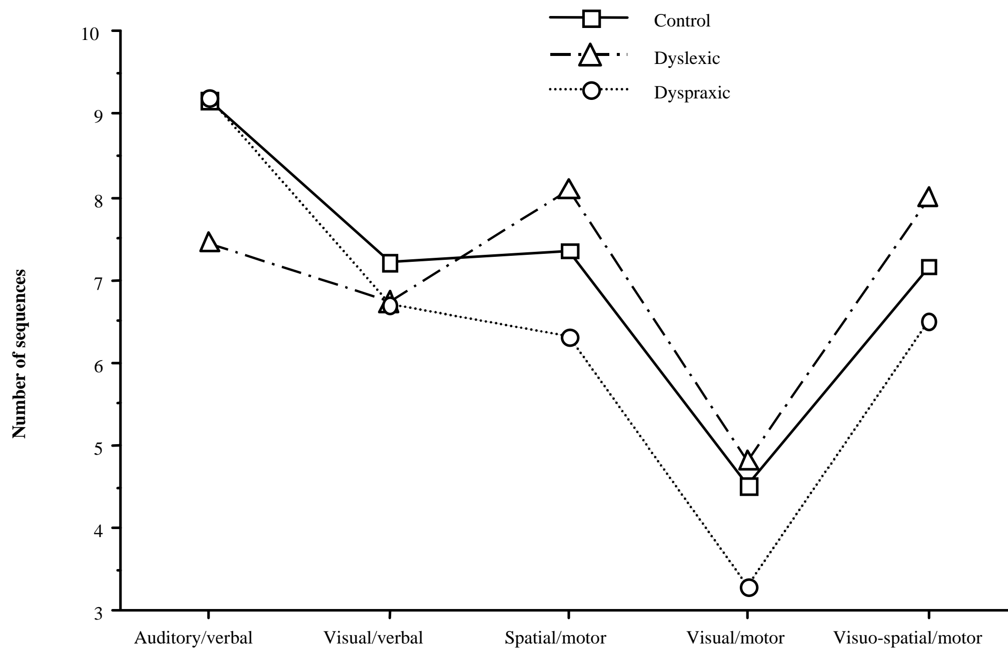
Results

Table 3 and Figure 2 present the average performance of each of the groups on the sequencing tasks.

Table 3. Average scores (with standard deviations in brackets) of each of the three groups for each of the sequence learning tasks.

Sequencing tasks	Dyslexic	Dyspraxic	No SpLD
Audio/verbal	7.45 (2.34)	9.20 (2.25)	9.17 (1.44)
Visual/verbal	6.73 (2.05)	6.70 (2.16)	7.22 (1.62)
Spatial/motor	8.09 (1.30)	6.30 (1.70)	7.35 (1.43)
Visual/motor	4.82 (1.78)	3.30 (1.77)	4.52 (2.25)
Visual/spatial/motor	8.00 (1.26)	6.50 (1.08)	7.17 (1.19)

Figure 2. The average number of sequences correctly produced by each of the groups in the sequencing tasks.



The findings suggest a pattern of performance such that the dyslexics show relative weak performance on the auditory-based task, whereas the dyspraxics show relatively weak performance on the visual and spatial tasks. These interpretations were supported by the statistical analyses performed. Analyses of variance compared the groups on each of the sequencing tasks. These produced significant effects in the Auditory/verbal task (F=3.5, df=2 & 43, p=.04), the Spatial/motor task (F=3.9, df=2 & 43, p=.03) and the Visuo-spatial/motor task (F=4.2, df=2 & 43, p=.02) but not in the Visual/verbal task (F<0.4, df=2 & 43) nor the Visual/motor task (F=1.7, df=2 & 43, p=.20). Post-hoc comparisons (using the Least Significant Difference procedure and an alpha level of 0.05) indicated that the dyslexics were significantly worse than the controls and dyspraxics in the Auditory/verbal task, but that they were significantly better than the dyspraxics on the Spatial/motor and the Visuo-spatial/motor tasks. The difference between dyslexics and dyspraxics also approached significance (p~.1) on the Visual/motor task, as did the differences between the controls and the dyspraxics on each of the motor-response tasks and the difference between controls and dyslexics on the Visuo-spatial/motor task.

Discussion

The dyslexics' scores on the auditory/verbal digit sequence task were significantly lower than those of the dyspraxics and controls. This results is consistent with views suggesting that dyslexics have a deficit in the phonological store and/or the articulatory loop subsystem of working memory (eg, McLoughlin et al, 1994). Such a deficit will lead to problems with the storage and rehearsal processes needed for immediate recall of verbally presented material. In contrast, the dyspraxic group scored significantly higher than the dyslexics on the same task and their performance was as good, if not slightly better, than the controls suggesting that the dyspraxics' phonological short-term memory may not be impaired. Dyspraxics, however, were much poorer on the measures that required visual/spatial and motor processes, which is consistent with these individuals' problems in these processing areas leading to poor short-

term storage of visual material. Again, this can be contrasted with the dyslexics who showed good performance in these visual-spatial short-term recall tasks indicating no evidence of deficits within the visual cache/inner scribe. Interestingly, the SpLD groups performance on the visual/verbal task was more-or-less equivalent, though only slightly worse than that of the controls. Although this specific result requires further substantiation, it suggests that processing that requires translation between visual and phonological areas may be equally difficult for both SpLD groups.

The dissociation between SpLD groups and type of material found in this study has implications for our understanding of the processing systems involved in the learning of new material, the categorisation of SpLD and the development of assessment and remediation programmes. The findings are consistent with Smyth & Scholey's (1994) evidence for the separation of spatial and motor memory functions from the phonological loop system (see also Baddeley & Logie, 1999). Similarly, evidence of differential performance in these sequence memory tasks argues for the need to separate these different SpLD groups rather than lumping them together in order to simply target areas of literacy deficit. Although both groups of adult SpLD individuals showed weaker literacy skills (eg, their spelling performance was worse than that of the controls), these weaknesses may be due to very different underlying deficits. Obviously, assessment procedures that incorporate measures of both visuo-motor and phonological skills would improve our understanding of the strengths and weaknesses presented by individuals with these SpLDs and such information may be useful in identifying appropriate remediation and effective support practices. The results indicate that dyslexics and dyspraxics have abilities and deficits in separate cognitive areas. This has implications for enhancement of working memory using different rehearsal strategies (McLoughlin et al, 1994) and when multi-sensory remediation is used to assist learning (Hulme & Mackenzie, 1992). As the central executive is said to co-ordinate the two working memory subsystems, encoding and retrieval of information could be improved by emphasising the stronger cognitive component. For example, dyslexics could support their poor auditory memory using visual and spatial rehearsal techniques, such as forming mental pictures, and dyspraxics could use auditory rehearsal describing visual information to aid recall of visual-spatial material: videos, audio tapes, 3D forms and computer graphics may all be helpful.

The results of this present study should be treated as informative for further work. Future studies need to be conducted on a wider range of SpLD individuals, both in terms of age of participant (ie, investigations of similar skills among children with dyspraxia and dyslexia) and severity of difficulties. For example, the degree of severity of dyslexia or dyspraxia may be related to sequence learning ability and, hence, implicate working memory processes in the determination of the level of difficulties encountered by individuals with dyslexia or dyspraxia.

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Practical Aspects of Inclusion for Dyspraxic Children in Primary Education

by

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INTRODUCTION

This article focuses on practical aspects of inclusion for dyspraxic children in primary education. Given that as many as 1 in 20 children may have some degree of developmental dyspraxia, class teachers and teaching assistants need to be aware of associated difficulties and positive support strategies.

'Inclusion' needs to be highlighted across the whole school day, focusing on playtimes and lunchtimes rather than just on classroom curriculum access. There is a vital link between pupils' experiences at school and their developing self-esteem, which is affected by the responses of school staff, peers and parents.

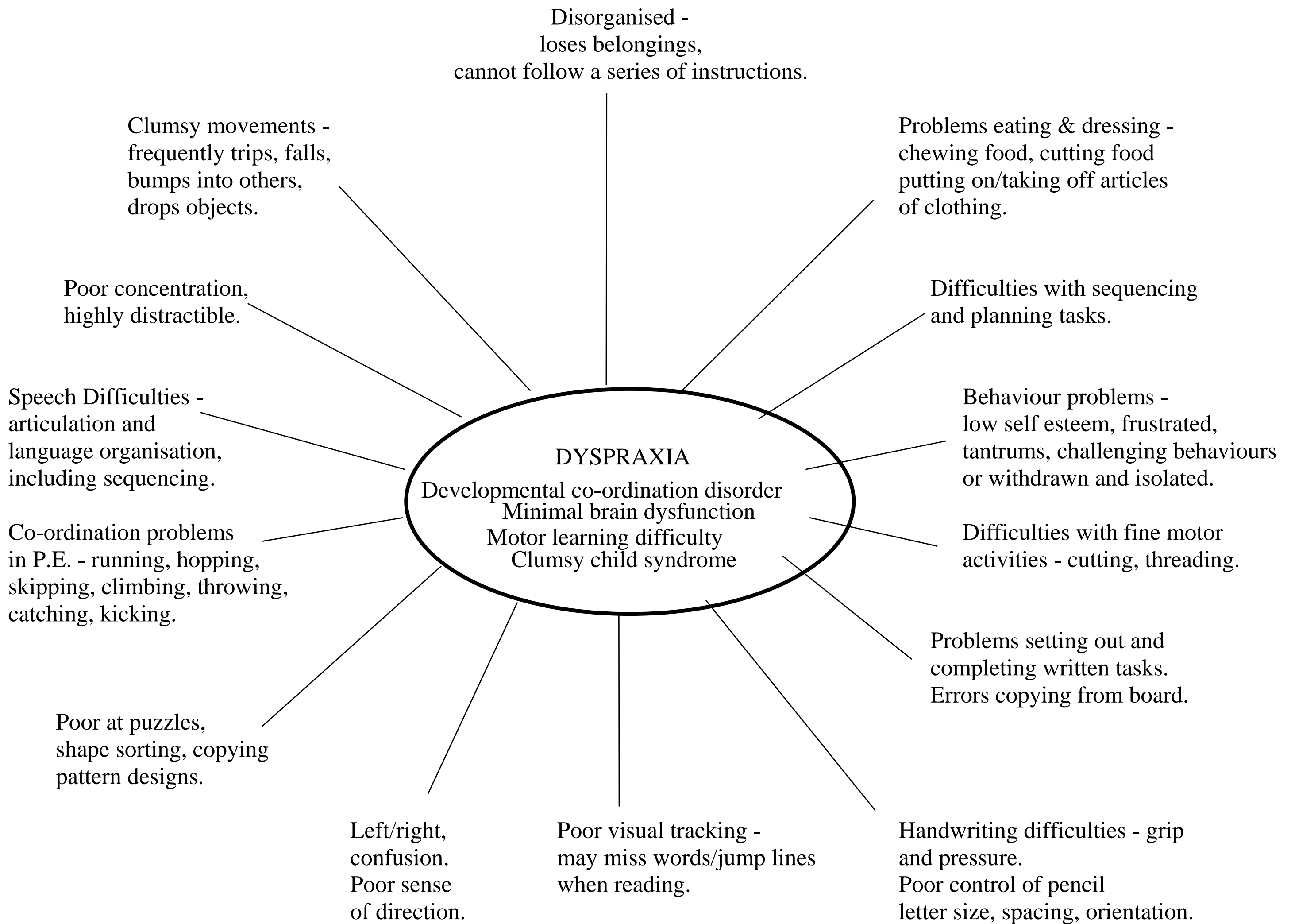
For children with dyspraxia, early identification and awareness raising in schools has to be a priority. As an illustration, Year 2 pupils may spend approximately 30% of their day on activities involving handwriting, which can be a major area of difficulty for a child with dyspraxia.. If a child's needs have been identified, strategies can be put in place for support to ensure that steps of success can be experienced. If this does not happen, the child may experience failure and frustration leading to other difficulties in school.

The following information areas may be useful to school staff, working in partnership with parents.

OVERVIEW

Developmental dyspraxia is a co-ordination disorder affecting the ability to plan and carry out complex movements, with an incidence of approximately 1 in 20 children. The web chart (Figure 1) shows the range of difficulties children may have in school. Some children have problems in all of these areas but other children have difficulties in only one or two areas.

WEB CHART TO ILLUSTRATE THE RANGE OF DIFFICULTIES THAT MAY BE EXPERIENCED IN SCHOOL



The severity of difficulty is also variable so pupils will have different profiles of strengths and needs, e.g. one child may tire during a long piece of handwriting, whereas another may have problems even gripping a pencil.

Dyspraxia can affect children of all abilities in particular areas of development. Children may have marked patterns of strengths and difficulties, e.g. above average language comprehension skills but significantly below average gross motor skills. Dyspraxia may also overlap with other Special Educational Needs, for example Specific Learning Difficulties (SpLD), Attention Deficit Hyperactivity Disorder and Aspergers Syndrome.

Children whose needs are not identified may struggle through school and home life for years without help. These children lose self-esteem and confidence, while frustration builds, as they feel failures compared to their peers. This can be one of the most serious effects of dyspraxia - when a child receives no help or understanding, behavioural and emotional difficulties can develop.

Identification of dyspraxia with following help at school and at home can give a much more positive outlook. Children can develop and improve skills, with support for self-esteem.

PRACTICAL HELP IN THE CLASSROOM

Dyspraxic children need specific help to develop skills through planned support and differentiation. There are many general strategies that help dyspraxic children in the following section. However, it is important that a child has a comprehensive medical assessment. This is to check for any medical conditions such as cerebral palsy that may be causing movement difficulties. Clearly, intervention may not be the same for other specific conditions as for dyspraxia.

Occupational Therapy, Speech and Language Therapy or Physiotherapy referral should be made as appropriate for individual children to provide full assessment and specific advice, as the needs of each dyspraxic child will be different.

General Classroom Strategies

1. Seat the child where access to equipment is as direct as possible, to avoid difficulties in moving around the classroom.

2. Provide as much space as possible both around the child's chair and on the work surface.

3. Encourage the use of a workbox or pencil case rather than equipment out on the table or desk.

4. Give instructions singly, repeat and ask the child to repeat back to you.

5. Differentiate tasks, including Literacy and Numeracy, by planning, equipment or expectations/outcomes as in the following examples:-

(a) Planning

When working with block graphs in Maths, the child may have great difficulty drawing the blocks on squared paper. For one lesson, the graph could be prepared for the child with just the last block to complete and the questions to be answered.

(b) Equipment

Access to I.T. for word processing when the main focus of a writing activity is content rather than handwriting presentation.

(c) Expectation/Outcome

In an Art activity, if the teacher is targeting cutting skills for the child, it may take the whole lesson to cut pieces of material and then the following lesson to make a collage, i.e. allow extra time or give smaller tasks.

6. In targeting specific skills for the child to develop, adapt the basic activity to match age and interest level. It can be difficult to find equipment suitable for older children to learn skills usually mastered at a young age.
   Useful examples:-
   Using a trainer/football boot fastened to a board to practise lace tying.
   For a child who still needs access to sand to develop handwriting through a

multisensory
approach, use a small container that can be put on the desk temporarily.

7. In difficult curriculum areas such as P.E. where the child may feel isolated, use equipment and co-operative activities that actively include the child,
e.g.
   - Parachute games
   - Specialist 'fun' equipment such as hedgehog balls that are easier for the
   - child to catch but that peers are keen to work with as well
   - Consider using a peer 'buddy' to partner the child
   - Dance can be positive in developing movement timing through rhythm.

8. Help older children to organise their work by making lists of tasks and equipment needed.

9. Allow extra time for changing at P.E. and ask parents to dress the child in 'easy' clothes
on P.E. days, e.g. tracksuits, shoes with Velcro fastenings.

10. Be sensitive to difficulties that are linked to dyspraxia, for example, the child may fidget while sitting at assembly time, but be unable to control this movement. However, do
establish clear behaviour expectations that the child <u>can</u> achieve.

11. All adults need to be aware of the child's problems and give positive encouragement and support. For example, meals supervisors need to know that the child may chew with an
open mouth or spill food because of difficulties caused by dyspraxia.

12. Personal and social skills activities such as Circle Time can be sensitively used to develop understanding and empathy from peers and to prevent bullying. Teachers need to use their own careful judgement on how to approach this aspect, as they would for a child with any Special Educational Need in the class. For example, peers will need to know why the dyspraxic child may have more time to use the computer, otherwise they
will assume 'favouritism'.

13. Social skills may also need to be developed, including body language and facial expression for social communication. Dyspraxic children may have difficulty in these particular areas, which are important in interaction and relationship building. Resources
such as photographs showing a range of emotions can be useful teaching aids.

14. The multisensory teaching approach will be helpful in all contexts:
   - Visual (Show it)
   - Auditory (Say it)
   - Kinaesthetic (Do it!)

For a dyspraxic child to achieve their potential, self-esteem and confidence must develop alongside learning. Understanding and positive support is as vital as help to develop new skills, alongside highlighting individual strengths.

CURRICULUM AREAS

Handwriting

Triangular pencils and pens (Handhuggers) or pencil grips may be useful equipment.
A range of grips are available. For example, moulded grips for children who need physical guidance with finger position.

Letter Formation

Letter formation practice in sand and using finger paint. Start with large movements using the whole arm then decrease in size as control develops, e.g. painting a single large letter on an easel sheet.
Finger trace direction on sandpaper/textured cut out letters.
To teach a directional framework, e.g. diagonal strokes, use pegboards.
Draw letters on child's back. Talk through letter formation - up, round, down, etc.
N.B. Try not to teach b, d, p together as can cause difficulties for children with perceptual problems.
For children who do not leave spaces, mark out spaces for them at the start or use a card finger spacer.

Fine Motor Control

Finger exercises, e.g. touching finger tips to thumb
Plasticine modelling
Finger painting
Finger puppets
Rolling marble between fingers and thumb
Squeeze and release rubber ball
Opportunities to practice fine motor activities - cutting, threading, pegboards, construction tasks.

Reading

Visual tracking activities left → right, e.g.:
Computer mouse control
Balloon games, bubble games (tracking and catching)
Pencil tracks and mazes
Ball rolling left to right
Pegboard patterns left to right
Shape and colour pattern sequencing left to right

Using a bookmark to cover text below/magnified text/limited text on a page for reading.
Ophthalmic consultants may provide advice for dyspraxic children with visual difficulties.

Maths

Differentiation may need to be focused on these areas:-

- Spatial and directional skills.
- Teach one direction only at first until fully established, i.e. left <u>or</u> right rather than introducing together.

- Reinforce with games in P.E. using directions.
- Simple activities using Logo computer programme
- Pegboard patterns to teach horizontal, diagonal directions and spacing, e.g. to discriminate between + and x signs.
- Formation of numbers as previously for letters, textured numerals, etc.
  Map work, co-ordinates and graphs - highlighted/bold marked lines can help. Also, concrete representation of block graphs, e.g. by Unifix cubes.
- Shape activities - drawing, discriminating between shapes and all aspects of associated work.
- Layout/organisation of work - be aware that squared paper may lead to difficulties setting out ‘sums’. Also, signs and symbols can be confused.

Sequencing
Picture cards to sequence into a story order - beginning, middle and end.
Writing frames to help structure and organise written work.
P.E.
This is often a focus curriculum area for dyspraxic children. Activities in P.E. to develop skills can be beneficial for other curriculum areas, e.g. directional games link into Maths skills.

Lesson start
Example: ‘Simon says’ game or point to named body parts and warm up one at a time, e.g. ‘Simon says put your hands on your knees’, or ‘Point to your shoulders. Roll your shoulders forwards and backwards’.

These activities may help dyspraxic children to identify, link and co-ordinate the movement of body parts.

Warm up
Example: Walk and run on different parts of feet, toes, heels, sides of feet. This strengthens the feet and ankles for balance. Bring in direction changes, as this can be a problem for children - teach forwards, backwards, sideways. To bring in visual co-ordination throw a balloon into the air and ask children to stop when it touches the floor.

Lesson focus examples:-

1. **Obstacle course:** Develops perception and motor planning.
   Use ‘soft’ obstacles to give the child confidence.
   When teaching directions, teach one at a time rather than introducing left and right together.

2. **Balance:** First strengthen feet and ankles by rolling textured-balls under feet and picking up objects in toes - P.E. bands, bean bags. Then use low balance beams to walk along, holding bean bags outstretched in hands to help balance. Try balancing on one leg for a given count, e.g. to 5 and then extend the target count.

3. **Co-ordination:** Throwing, catching and kicking. Before catching, rub hands together to ‘warm up’. Use balls of different textures - body balls, sensi-balls. Start with rolling balls along own body, round an obstacle course, to other children. Then

teach throwing and catching, initially bouncing ball as this is easier. For practice, try throwing bean bags at targets, into hoops. Set up skittles and decrease size of ball/increase distance as aim improves. When working with dyspraxic children on foot-eye co-ordination it often helps to give them a large ball or other weight to hold. This prevents fist clenching and brings arms down to sides of body.

USEFUL EQUIPMENT AND ACTIVITIES FOR P.E.

Many of these activities are useful for children with a range of special needs (not only for dyspraxia). However, for children with specific physical disabilities always get advice from physiotherapy or medical services.

Balance:

- wobble board
- low balance beams
- body balls
- hand and foot prints
- mini stilts (stampabouts)
- Heel and toe walking, gripping objects with toe
- Walking along rope and bean bag trails (pre balance beams)

Partner work:

- partner exercises, e.g. pushing both feet together, alternate backwards and forwards movement, against partner's feet
- mirror movements with partner
- focus on a body part as a theme for one lesson,
- 'sports acrobatics' activities, e.g. counter balances

Co-ordination:

hand/eye

- catching (rub palms together to prepare)
- scarves, textured balls, balloon, bubbles, foam ball and large skittles, throwing rings, 'scatch' - velcro glove and ball equipment

foot/eye

- target aiming, obstacle courses, footprint and hoop patterns

Mid-line crossing:

- hand to foot opposites exercise
- rolling, kicking a ball left to right and back

Development of strength + stability:

- knee balances
- shoulder balances
- wheelbarrows
- arm circles with beanbags
- turning skipping rope (shoulders)

PARENTS INFORMATION
Activity ideas to give parents for use at home to help skills development

1. Learning the names of body parts and how they connect.

Useful equipment and games: Puzzles of body parts
'Twister' game
'Simon Says' games

2. Gross motor - this means body movements: walking, running, hopping, skipping

Balance: Stilts
Space hopper' - large ball to sit and bounce on
Gripping activities with toes - picking up easy objects

Throwing and catching:
balloons, bubbles
large foam balls (textured surface)
rings, beanbags, scarves (thin floating material)
Rub hands together before practising

3. Fine motor - this means activities using hand control and hand/eye co-ordination

For handwriting, using cutlery, dressing, buttoning, lacing.
Strengthening finger muscles: finger games, puppets
finger painting
plasticine, playdough

Finger sensitivity: blindfold games
feeling textures with eyes closed
bubble wrap
sand paper
wool

Other activities: computer mouse control
bead threading
lace threading cards
pegboard - pattern copying

Handwriting: finger writing in sand, other textured surfaces
pencil mazes
dot-to-dot books
tracing, stencils
pencil grips, chubby pencils (large size)
triangular pens/pencils

4.	**Reading:**	activities to improve visual tracking (eye movements left to right for reading) left to right pencil games, e.g. take bee to the flower (drawn on paper) rolling ball left to right

USEFUL BOOKS

Praxis Makes Perfect II
Dyspraxia Foundation
8 West Alley
Hitchin
Herts SG5 1EG
Tel: 01462 454986

Developmental Dyspraxia
Madeleine Portwood
Durham County Council
EPS, County Hall, Durham DL1 5UJ
ISBN 1-89-7585-217

Dyspraxia - A Guide for Teachers and Parents
K. Ripley, B. Daines, J. Barrett
David Fulton Publishers
ISBN 1-85346-444-9

Graded Activities for Children with Motor Difficulties
James P. Russell
Cambridge University Press
ISBN 0-521-33852-2

Development of Beam – A screening package for schools aiding identification of children with co-ordination difficulties

by
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This report describes the development and introduction of **BEAM**, (**B**alance, **E**ducation, **A**nd **M**ovement) an initiative developed by Paediatric Physiotherapists for use in Mainstream Primary Schools to enable Primary Schools' staff to identify children with motor difficulties during their first term in school..

The Paediatric Physiotherapy Service in Maidstone, Kent is spread across four Multi-disciplinary Therapy teams - Early Intervention and Pre-school, CDC, Special Schools, and Mainstream Schools Teams. The Mainstream Therapy Team provides therapy support to children mainly in the Mainstream Schools setting. The Paediatric Physiotherapists in the Mainstream Schools team manage a mixed caseload of children with long term neurological / degenerative / orthopaedic conditions. The Service operates a policy of open referral from involved NHS and Educational professionals, ensuring early identification and facilitating early referral to other relevant professionals.

Between 1993 and 1997, there was a marked increase in the rate of referral to Physiotherapy of children with unspecified co-ordination difficulties.(see fig.1) Without assessment it was impossible to ascertain from the referrals whether these co-ordination difficulties were due to lack of early motor experience or had more complex difficulties such as Developmental Co-ordination Disorder (DCD). During the period studied, the caseload of children with identified handicaps remained fairly constant (see Figure 2)

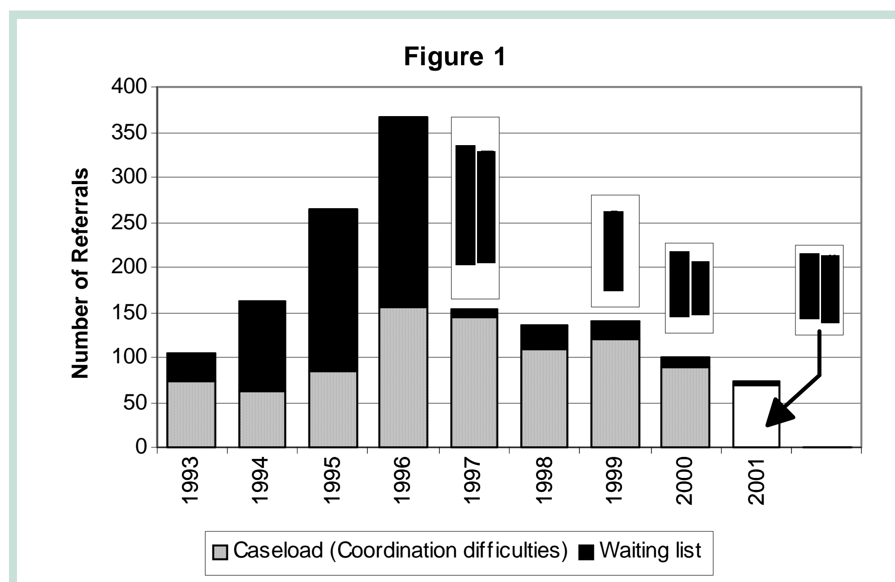


Figure 1 Results showing variation in the number of referrals of children with co-ordination difficulties over the period of study.

All referrals are classified according to the referrer information in accordance with West Kent Health Authority Priorities. As a result of applying these priorities, a waiting list of 200 children rapidly developed. Service resources were sufficient to offer a Physiotherapy service to children in categories 1(urgent in-patients), 2(urgent community), and 3(priority). Service provision to children in category 4(non-urgent co-ordination and minor orthopaedic) needed consideration.

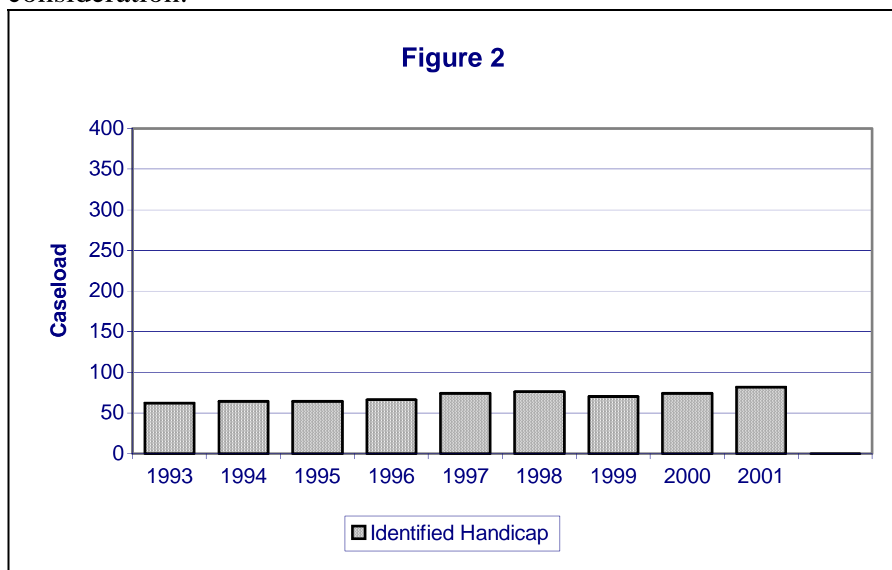


Figure 2 Results showing caseload consistency of children with identified handicaps over the study period.

Enquiry letters were submitted to professional journals. Responses revealed a similar increase in referrals nationally. Literature searches were carried out. Of particular interest was the work of Michele Lee, a Paediatric Chartered Physiotherapist who specialises in DCD. Michele's work has shown reliable improvements achieved through 8 weeks of progressed gross motor activities, alongside a home programme, and clearly defined outcome measures. The Physiotherapists were given full permission to use all her material

In the context of the Mainstream Service the Physiotherapists decided that an eight-week programme could be adapted, to provide a service for this group of children. This was incorporated into an Advice Booklet, which was devised by the Physiotherapists and distributed to the families of children on the waiting list A regular Out-Patient Clinic was established at which appointments were offered within one school term.

By 1998 the Physiotherapists were in a position to review local provision for children with co-ordination difficulties. It was felt there were no means of identifying all these children early, before additional problems occurred and no consistent Standards for referral for Physiotherapy. The Physiotherapists decided that the difficulties of children with lack of motor experience could be seen as a developmental and educational issue, which could be addressed in the school setting and, through screening and the opportunity to practice gross motor activities, be differentiated from children with DCD who require additional Therapy input.

In 1998 the Physiotherapists began to be introduce Gross Motor Programmes into Primary Schools. These were run by school staff, following instruction by the Physiotherapists.. Children, included in the groups, were identified by the school as having a variety of movement difficulties. Teaching staff were enthusiastic in their support as it became evident that the children's listening skills, ability to sit still, eye tracking, gross and fine motor skills had improved following participation in the groups.

Research suggests that nationally 6% of children experience co-ordination / planning difficulties which affect their ability to reach their full potential. School entry offered the first realistic opportunity to screen all children for co-ordination difficulties. If the existing gross motor programme was to be restructured into a screening programme and be extended to all schools in the district, a documented study would be needed. In the Autumn of 1999 a Pilot Study was undertaken in 9 local Primary Schools.

The schools included in the study were selected to give as much variety as possible. The Physiotherapists instructed school staff in the delivery of identical 8 week programmes, with Individual Child Checklists, to be carried out at the beginning and end of the eight weeks, to measure outcomes. This checklist consisted of core stability activities, illustrated diagrammatically. The programme was split into four two weeks sections. Children included varied in age and were identified by the school staff. Results from the Pilot Study were collated by the Trust Clinical Audit Department during 2000. Audited results of the study showed improvements across all participating school groups . Figures 3 and 4 illustrate the range of results from the audited schools. Figure 5 illustrates the Mean improvement achieved across these groups. School staff were enthusiastic about the improvements noted in the children.

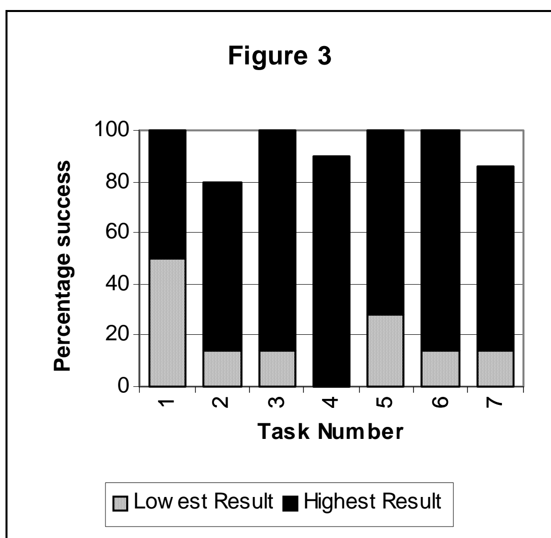
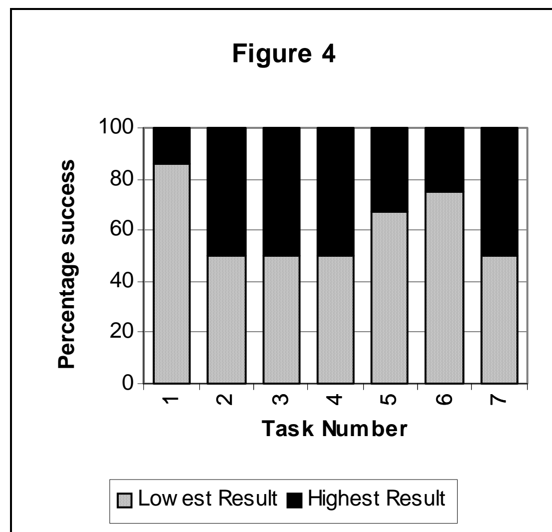


Figure 1 Results of Individual Child Checklists prior to 8 week programme

Figure 2 Outcome Results of Individual Child Checklists following 8 week programme



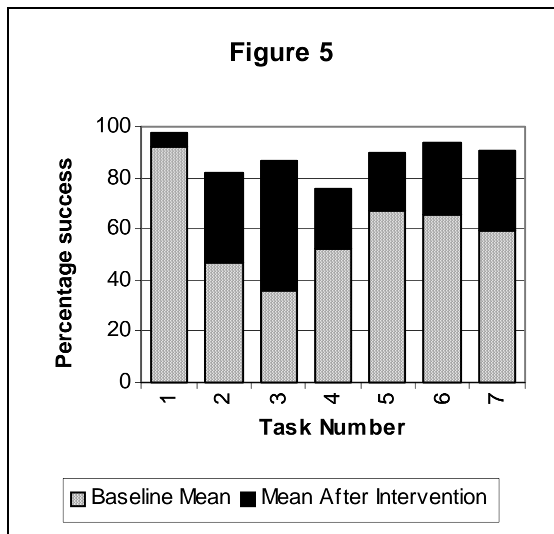


Figure 3 Indicating Mean Improvement across all school groups

Following the Audit the project was extended to 6 primary schools in Autumn 2000 as a screening tool – **BEAM** (Balance Education And Movement). Participating schools were asked to run the first 6 weeks of the Pilot package for the entire Reception class (1999 Results suggested that weeks 7 and 8 progressed too quickly for this age group). Individual Child Checklists were replaced with Individual Progress Sheets. School staff were asked to run follow-up small group sessions, with no time constraint, for pupils who were progressing more slowly than their peers.

Throughout 2000, 2001, **BEAM (**with it's distinctive "Lighthouse" logo and connotations of "balance" and "confident smiles") was established in many local schools. Children who were initially sent an Advice Booklet now had the opportunity of participating in the follow-up groups

In 2002 the **BEAM** package was created. This consists of a Protocol for its use, explanatory and guideline sheets, pictorial activity sheets, individual progress sheets, and completion certificate

In 2002 Maidstone Education Standards Fund funded the printing and distribution of **BEAM** to all local Primary schools enabling them to screen children in their first term at school alongside the Foundation Stage Assessment following the **BEAM** Protocol. It is very encouraging that Reception children across the district can improve their Gross Motor Skills prior to the National Curriculum P.E. in Year 1. Children identified through the **BEAM** Screening Programme as experiencing co-ordination difficulties now have the opportunity to practice their Gross Motor skills in the non-threatening environment of the follow-up **BEAM** school groups. Most of these children were not identified before school entry.

Children with a wide range of diagnosed conditions (e.g. D.C.D, D.A.M.P., Down's Syndrome, Aspergers Syndrome, mild Cerebral Palsy, Developmental Delay., hypotonia, lax ligaments etc.) resulting in co-ordination difficulties, can successfully be included in the **BEAM** programme dependent on liaison with the child's Therapist. The small number of children with more complex difficulties who fail to make the anticipated progress in the follow-up group now have easy access to paediatric services in Maidstone for further assessment and advice. Physiotherapy Out-Patient Referrals to the Physiotherapy Outpatient Clinic should be accompanied by a completed **BEAM** Individual Progress Sheet and observations, which act as a baseline for further investigation.

Although the **BEAM** package has been developed to be self-explanatory, training of school staff in the its delivery is offered by the Mainstream Schools Physiotherapists through the Local Learning Group network.

More effective inclusion in Mainstream Schooling has been achieved as a result of introducing screening by **BEAM** across the district. As children with delayed motor experience now have the opportunity to improve their gross motor skills within school, it has enabled the Physiotherapists to target their skills more appropriately. Children with more complex difficulties can now be assessed by a Paediatric Physiotherapist with minimal delay as the Health Authority Priorities can now be met for this group of children. Considerable interest has now been expressed in **BEAM** across Britain.

It was concluded from this study that screening Reception – aged children using **BEAM** facilitated early identification of children with co-ordination difficulties. They were able to make significant progress in their delayed Gross Motor Skills, allowing greater access to the National Curriculum. Children with more complex difficulties were referred more quickly for Physiotherapy.

BEAM is available for purchase for £15 + p&p from The Mainstream Therapy Team, Foster Street Clinic, Foster Street, Maidstone, Kent ME15 6NH tel :01622 226075

Dyspraxia/DCD – The Child's Perspective.

by
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Abstract.
Dyspraxia/DCD is a condition which studies suggest affects between five and eighteen percent of children in the United Kingdom (Godfrey, 1994; Hall, 1994; Marks, 1994; Portwood, 1996). Its consequences are complex and far reaching, affecting the child's social, motor, language and perceptual skills and reasoning ability. The condition is now well documented, but poorly understood amongst many of those who have a direct influence on the child's ability to succeed.

This piece of research was undertaken in 1997 as a pilot study to ascertain how children with dyspraxia view themselves, compared to how parents and professionals view **them.**
During the process of reviewing available literature and research undertaken into the subject, seven common themes emerged as being particularly relevant to children with dyspraxia and the research concentrated on these themes:
Behavioural problems.
An avoidance of physical activities.
Low self esteem.
Social isolation.
Learning difficulties.
A focus for bullying.
The need for early recognition.

By means of interviews, and a small scale survey the study reveals a largely enthusiastic and positive group of children, with a healthy self-image and an enjoyment of physical activities, which is in sharp contrast to work published to date.
Reservations exist, however, in the small scale of the study and in the fact that all those who participated were recognised as having difficulties which were responded to.
Following the collection of data, the children's perspective was compared to well-researched and established perceptions of teachers, parents and health professionals, ascertained via a review of current literature.
There is a strong plea for greater awareness of the condition and the difficulties it imposes.

Introduction.
The main **aim** of this exploratory study was to ascertain how children with dyspraxia view themselves, compared to how parents and professionals view **them.** To establish if there is any significant difference in their perceptions, and to identify any limitations in the proposed approach, with a view to further research around the same topic.
This was be achieved by:

- searching the available literature to investigate established attitudes to children with dyspraxia amongst parents, teachers and health professionals, and focus upon any common themes, which emerge.
- establishing how children with dyspraxia perceive themselves.
- comparing the results.

Rationale.
This research was undertaken to establish if there is a need to explore the issues that arise in a longer more detailed study.
The conclusions drawn can then form the basis of further research into how the child's viewpoint can be used as a positive learning tool by health and educational professionals when programmes of remediation are put into place.

Methodology.

Semi structured interview**.**
The researcher gained permission to meet with a group of children with dyspraxia, unaccompanied by their parents, via the occupational therapy department at a local district hospital. Permission to talk to these children was gained in writing from their parents prior to the interview taking place. The children were interviewed as a group in order to reduce stress.
This planned interview was supplemented by **informal unstructured interviews** which were conducted during opportunities arising from the request for information at a national co-ordinators meeting of the Dyspraxia Foundation, and were used to compare one persons perceptions with another's. (Letterman, 1989).

A small scale survey.
This was chosen as a means of extending the data collection, allowing the research to be conducted over a wider geographical area, with a larger number of individuals.
This would increase the validity of the results.
In the first instance the questionnaire (see Appendix 1) was sent to a pilot of six children, chosen at random by the staff at the head office of the Dyspraxia Foundation. This was done to establish that the questions were interpreted as they were meant and that relevant information was returned. A further fifty were then sent. Ten each to five different local co-ordinators throughout the country. The co-ordinators had been briefed about them at a national meeting and were requested that where possible the children were asked to complete them at the social evening arranged by the group in order that their families did not influence them. It was acknowledged that handwriting is difficult for children with dyspraxia and so a certain amount of help may be needed.
A total of twenty-six questionnaires were returned.

Collecting, dealing with and analysing the data.
Notes were taken during the informal interviews and semi structured interviews were audiotaped and processed, highlighting common themes which emerged during the recording.
Triangulation was evident in the use of multiple methods of data collection and by obtaining information about the perceptions of dyspraxics from various sources.

Robson (1993) describes triangulation as an indispensable tool in real world enquiry, particularly valuable in the analysis of qualitative data.

Notes made during the informal interviews were written up shortly after they were taken to ensure legibility and complete understanding of the contents as was meant at the time they were written.

Collected data was coded into categories of themes raised by research questions. This enabled the researcher to relate categories to each other, and establish what emerged as the core categories of the research.
Due to the relatively small scale of this research processed data was organised in a set of *mundane files (* Lofland & Lofland, 1984).
Results from the interviews with children, and completed questionnaires were to be displayed as a bar chart in the first instance.
A matrix table to highlight common themes amongst teachers, parents, health professionals and children was used to enable an easy comparison of results.
Concerns regarding personal bias were acknowledged.
According to Gavron (1966) *'awareness of the problem plus constant self control can help'*.
Every effort was made to exclude personal bias in the realisation that it would only serve to cloud the results.

Ethical considerations.
There were no direct ethical considerations on a professional level. However, certain attributes of good practice required consideration.
In the area of interviews, whenever the intended interviewees were less than sixteen years of age permission was gained from their parents or guardians for the interview to take place. No names would be published.

The executive committee of the Dyspraxia Foundation has been consulted and has given their full support to the proposed research.
The author alone completed the whole study.

Results.
Children with dyspraxia do not form a neat, homogenous group. With variations in both the severity and range of motor problems (Henderson, 1987, Maeland & Sovik, 1993), the difficulties of one child are not the same as those of another.
With difficulties in motor planning and the organisation of movement, visual perception, speech and language, reasoning and thought, the effects of dyspraxia are well documented and it is known to impact greatly on a child's educational success and home life.

<u>The Teachers View.</u>
In an information booklet produced by The Occupational Therapy Department of the Royal Aberdeen Children's Hospital, teachers reported to have felt frustrated, bewildered, annoyed, exasperated, angry, uncertain and panic stricken when presented with a child with motor learning difficulties. Comments about the child's performance were largely negative. In a study by Losse et al (1991) teacher perceived the 'clumsy' subjects as much less competent than their peers and suggested that they had more behavioural problems. Selikowitz, (1992) suggests that some of these children enjoy school, many do not. Butler (1991) states that these children **will** avoid physical activity, and this is reinforced by Poustie (1997) who suggests that '*the individual is less likely to take part in physical leisure pursuits'.*
Portwood (1996) suggests that dyspraxic children represent a significant educational underclass, largely misjudged, frequently maligned and extensively ignored. A study by E Stephenson (1986) suggests that teachers may be unwilling to admit defeat, when they do not understand the condition, or know where to turn for help, but that once these obstacles are overcome they cope well, and are able to talk positively with parents and children.

Recognition of the difficulties is, therefore, of extreme importance to the child's chances of progress, and the first person to recognise that a problem exists will often be the class teacher.

<u>The Therapists view.</u>
Paediatric occupational, speech and physiotherapists are central to effective remediation programmes for dyspraxic children. It is worth remembering that the majority of the existing research is, on the whole, undertaken by well informed; empathic individuals who strive to improve the child's chances of success.
A general overview of the therapists view of the dyspraxic child can be illustrated as shown in research by Chu, 1991; Cocks, 1992; Nash-Wortham, 1979; Ayres, 1979; and Penso, 1993. All agree that children with dyspraxia can be recognised by the following features: poorly organised children who 'get in a muddle' (Cocks, 1992), forget where they have put their belongings, look awkward and uncoordinated in their overall body movements, are messy eaters, loners who sometimes find it easier to 'give up' than to be teased and rejected, putting them at risk of being socially isolated. They are vulnerable, and can easily lose confidence in themselves leading to a potentially overwhelming sense of failure, and poor self-esteem. Nash-Wortham, a speech therapist, suggests that if people are faced with a child with difficulties for which there is no easy solution or known remedy, the interest in the problems wears thin rapidly. Cocks (1992) reports these children as' *often hyperactive, impulsive or daydreamers. They **look clumsy'*** and according to Selikowitz (1992) these children: *'have been described as being "socially tone deaf", They may be uninhibited, tactless and oblivious to the emotions of others'.* Therapists at the Royal Aberdeen Children's Hospital in their booklet 'The Child with Motor/Learning Difficulties' comment:
'Sports day for some children may be avoided at all costs. They will come out with the most bizarre excuses in an effort to escape taking part in an activity in which they know they are certain to fail'.

A general consensus amongst health professionals is that early identification of dyspraxia is extremely important so that the child receives the help and attention he needs.

The parents view.

In a research article by Chesson et al (1991), in which thirty two families with a dyspraxic member between five and twelve years of age, were involved over a two year period, parents were largely positive about their children's' school performance even though it was not age appropriate.

Nine sets of parents saw peer relationships as concerning, viewing their child as a focus for bullying, ridicule and social isolation. They saw the child as a 'loner', unable to make friends with their peers, reluctant in sports and games. An unwelcome team member. This in turn caused them to be aggressive.

They viewed the recognition of their child's difficulties as a turning point, creating a greater understanding and desire to help by the teachers, which had a positive affect on the child's overall performance. They saw behavioural problems outside of the classroom, (particularly in the playground) as a common feature. One parent when asked about their child commented: *'I want him to be acceptably co-ordinated. To meet a girl at sixteen at not be laughed at.'*

In an exercise to collect information for a booklet staff at the Royal Aberdeen Children's Hospital, parents comments included: *' …he is a target for bullies and I get the impression he is alone in a crowd!' 'Phrases like "I can't do it" become common, as his self esteem ebbs away.' 'It is heartbreaking seeing him failing time and time again and giving up.'*

Parents felt largely negative about the effects of dyspraxia on the child's behaviour, self-esteem and learning.

Interviews.

A group of ten children took part in semi structured interviews. It should be noted that all these children had been recognised as dyspraxic and were in receipt of support within the classroom and outside during therapy sessions.

Four of the ten reported some form of behavioural problem. All ten were extremely enthusiastic about physical education and sport. Two were withdrawn and chose or were not able to become involved unless the questions were directed specifically at them. A degree of social isolation was detected in two of the group members, although not categorically stated by them. The remainder were very active socially, all were members of groups and enjoyed the company of friends. Six of the members were in receipt of learning support in school. The subject of bullying was not specifically raised at interview and members gave no voluntary indication of its existence. This category was therefore omitted in Figure 1.

All ten were pleased that their difficulties had been identified, and claimed that the fact that they had been, enabled them to take more risks without fear of reprisal when they did not achieve what they had set out to do. These results can be seen in Figure 1.

The results of the small-scale survey were comparable to those determined during the interview.

Four of the twenty-six respondents reported behavioural problems. Twenty were enthusiastic about physical education and sport, six of those twenty stated that games was their favourite subject at school. One child commented that he '*thoroughly enjoyed sport but was not very good at it'.*

Six commented that they lacked confidence and did not like themselves, and six felt socially isolated and did not have any friends. All twenty six respondents found some aspect of learning difficult and felt in need of some additional support (not all were in receipt of that support at school). Four admitted to being teased or bullied. Sixteen of the respondent's felt that early recognition was important, but it is worth noting that fourteen of the group would rather keep their diagnosis from their peers. These results can be seen represented as a percentage in figure 2.

On completion of the analysis of these results, the perceptions of those involved in the study were compared to the perceptions of teacher's, parents and health professionals and these were formatted into a matrix table (Figure 3).

Figure I

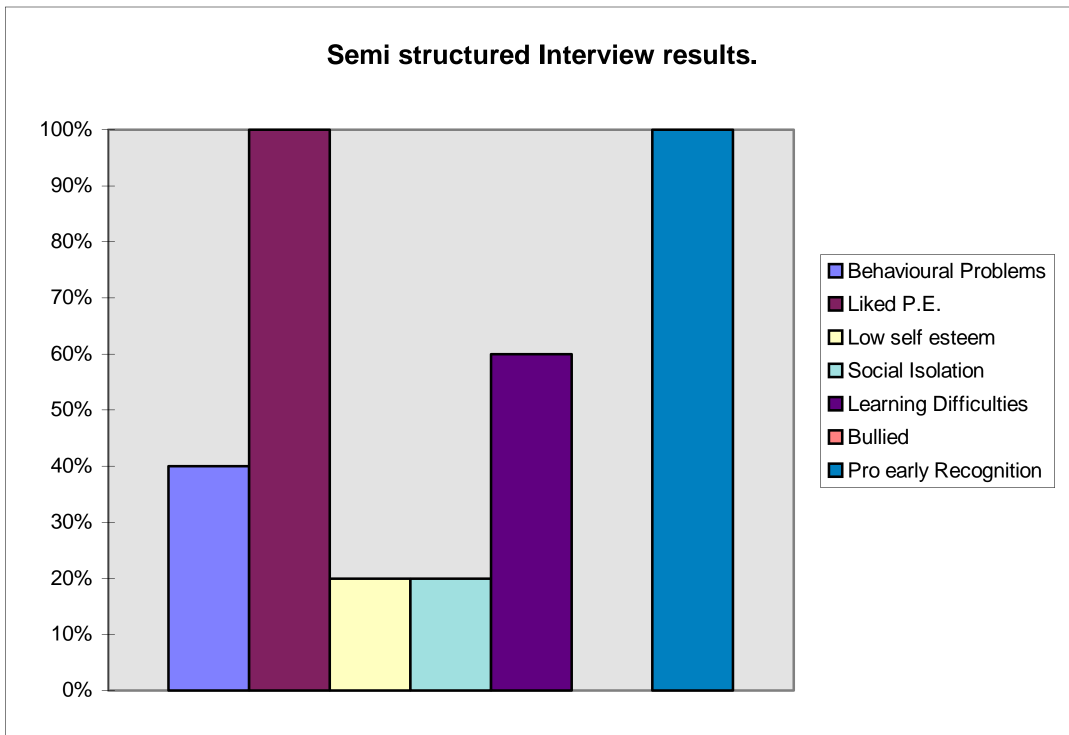

Figure II

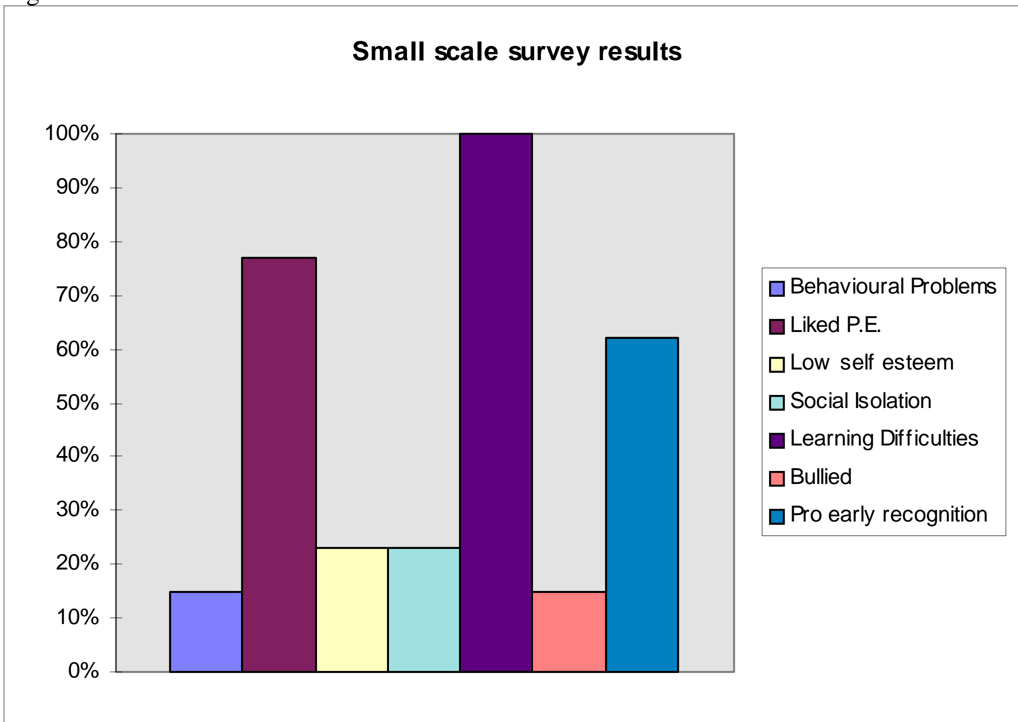

Figure III

	Parent	teachers	health Professionals	**The Children**
BEHAVIOURAL PROBLEMS	AGREE	AGREE	AGREE	**MAJORITY DISAGREED**
AVOID PHYSICAL ACTIVITY	AGREE	AGREE	AGREE	**MAJORITY STRONGLY DISAGREED**
LOW SELF ESTEEM	AGREE	AGREE	AGREE	**MAJORITY DISAGREED**
SOCIAL ISOLATION	AGREE	AGREE	AGREE	**MAJORITY DISAGREED**
LEARNING DIFFICULTIES	AGREE	AGREE	AGREE	**MAJORITY AGREED**
BULLIED	AGREE	AGREE	AGREE	**MAJORITY DISAGREED**
PRO EARLY RECOGNITION	AGREE	AGREE	AGREE	**MAJORITY AGREED**

AN OVERVIEW OF CHILDREN'S FEELINGS COMPARED TO THOSE OF PARENTS, TEACHERS AND HEALTH PROFESSIONALS.

Discussion.

The aim of this study was to establish the feelings and perceptions of children with dyspraxia about their difficulties and it was successful in doing that.

The results are both interesting and heartening. The most dramatic difference in the findings was in the area of physical activities.

Even though the physical manifestations of dyspraxic difficulties, which are well documented, may lead adults to assume that the child will find games and sport difficult the results indicated that this does not necessarily mean that they cannot enjoy them. Indeed the majority of the children involved in the study participated in sport enthusiastically.

The area of social isolation can be a matter of individual interpretation and so some form of framework for its definition would have been beneficial prior to the collection of data. One child, for example, did not appear to consider himself isolated, even though all his free time was spent playing computer games on his own. He viewed this as a matter of personal preference.

Bullying is a sensitive area, and some allowance had to made for this during the face to face interviews. It may have been that some of the children were experiencing some degree of bullying but chose not to disclose it.

The indication is though that much of the way the child feels about himself and the ways others feel about him are related to the early recognition that dyspraxic difficulties exist.
A further study into the feelings of children with dyspraxia whose difficulties had been recognised and responded to early in life, compared to a group who were not diagnosed until adolescence or adulthood would be useful.

The study established that this group of individuals, thirty-six in total, was largely made up of young people with a very positive outlook on life.

Conclusion.

The study was interesting in that it showed that the feelings and perceptions of children with dyspraxia about themselves differs from that of the adults to whom they are entrusted, in all but two pre determined categories.

All those involved expressed a great need and desire for early recognition of the difficulties, which could then be responded to appropriately. This corresponded to the views expressed by adults in previous research. However, the extent to which this is achievable realistically could well form the basis of a separate research project.

It would be worth returning to the interviewees and respondents involved in this study to establish what they consider to be the major influences on their feelings, what they might change, and what advice they might give to those who influence their lives. The individuals with dyspraxia could then draw up a working framework for success, rather than non-dyspraxics trying to empathise with them.

Selikowitz (1992) suggests that: '*other children, teachers, relatives and society in general, play an important part in determining how a child sees himself and how well he copes'.*

Whilst the research did not set out to discover the truth behind a statement such as this, the results implied that this is indeed the case.
On the basis of this study it is reasonable to suggest that the adults involved with children with dyspraxia have a very much more negative feeling about their ability to cope that the children themselves do. It is possible that this negativity imposes itself on the child. Although the feelings of the group involved in this study were in the main positive and enthusiastic.

This was a very small-scale study and exploratory in nature. A large percentage of the results are very much in contrast to the perceptions of others, which have been well researched over the years. In view of this, a similar study on a much larger scale is indicated to enhance the reliability and validity of the conclusions drawn from this pilot study.

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Appendix 1.
The questionairre.

Calling all youngsters with dyspraxia!!!

My name is Gill Dixon and I am writing a project about how it feels to have dyspraxia.

I need your help!

In order that I can be realistic I need to know how YOU feel, and not how I think you feel.
I would be grateful f you could complete the following questionnaire.
You do not need to give your name unless you want to. If you ask someone to help you try not to let them influence what you have to say.

1. Are you a boy or a girl?
2. How old are you?
3. Do you like school?
4. Do you find anything difficult?
5. Do you like playing with other children or do you prefer your own company?
6. Do you have any hobbies? If so, what are they?
7. Do you get teased or bullied at school?
8. Do you have a 'special' person to help you at school?
9. When you find something harder than other people seem to, do you ever feel like 'giving up' or are you always keen to try again?
10. Do those around you recognise your difficulties?
11. If they don't, do you wish that they did?
12. In your own words how would you sum up how it feels to have dyspraxia?

WANTED: Volunteers

The Dyspraxia Foundation is looking for volunteers to be advisors on the medical panel. The main duties involve answering questions from your own speciality and giving advice to the executive committee. The amount of input required by you is generally minimal but offers a much needed service. If you feel you could help please contact the Hitchin office on 01462 454986

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