

AN ANALYSIS OF THE EFFICACY OF A MOTOR SKILLS TRAINING PROGRAMME FOR YOUNG PEOPLE WITH MODERATE LEARNING DIFFICULTIES

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A secondary school for children with Moderate Learning Difficulties had requested assistance from psychological services for pupils that the school felt were experiencing poor motor-coordination and in some cases low self-esteem. An intervention programme for children with dyspraxic type difficulties (Portwood, 1999) was proposed as a suitable improvement programme for the children identified as being most in need of assistance (n=6). The programme ran for eighteen weeks (four weeks of the daily exercise programme, four weeks rest, and once again four weeks of the exercise programme). Pre and post-testing was carried out in the areas of speed of handwriting (Wallen et al., 1996) and general gross coordination improvement. It was deemed suitable to attempt to measure improvement with regards to speed of handwriting due to its relevancy in most facets of education. The results indicated that there was a significant level of improvement in the experimental group with regards to the speed of handwriting and also in general gross motor coordination. All members of the Video Review Panel felt that there were strong levels of improvement in the subjects (ranging from 45% to 65%). The participant staff members of the project school unanimously agreed that the intervention programme was worthwhile and that tangible benefits had been brought to both the children and the school as a result. Despite the small sample size, it was felt that there are implications for how children with moderate learning difficulties are viewed when improvement programmes are planned and implemented.

Background and Historical Perspective

Dyspraxia, and the awareness of the condition, has grown over the last 2 decades, and has previously been known by eleven different names e.g. *Clumsy Child Syndrome*, *Perceptuo-motor Dysfunction*, *Minimal Brain Dysfunction* and *Motor Learning Difficulty* (CAF 2002). It was not until Gubbay (1975) used the term *Clumsy Child Syndrome* that it became a *disorder*. Classifying a child as *clumsy* is rather pejorative and this term has been consigned to the annals of medical history. Currently, the terms most widely used by professionals are Dyspraxia and Developmental Co-ordination Disorder (DCD). The latter term was initially used in 1987 by the American Psychiatric Association and is the favoured term of professionals in the USA (MacIntyre, 2000). There are subtle differences between the two terms but both terms will be used interchangeably in this paper, except where specifically stated.

Interestingly *Psychological Disorders in Children* (Ross 1974) hinted at the concomitant circumstances that could exist between reading difficulties and finger localisation thereby indicating the possibility that children who were regarded as *retarded* in reading may well have been affected by what we now know to be dyslexia or dyspraxia or a combination of the two. This was further exemplified by the findings that children with learning difficulties take longer to process information than their unimpaired peers. Ross also highlights a recurring theme across the many studies of children with learning difficulties, such as attention problems which is now an associated symptom of dyspraxia and highlights a concomitant relationship with ADHD.

Children with learning dysfunctions are often described as having poor motor control and low attention spans and as being hyperactive and impulsive. (Ross, p.112)

Causes and Definitions of Dyspraxia

A definition of dyspraxia can vary depending upon the source but there is some consensus that it is an impairment or immaturity of the organisation of movement with associated problems of language perception and thought (Chu, 1995; Kirby, 1999). Herbert (2003) describes the condition as

...a disorder of the higher cortical process involved in the planning and execution of learned, volitional, purposeful movements occurring in the presence of normal reflexes, power, tone, and sensation. (p.224)

Motor skills can be difficult to acquire and language development may be delayed. On occasion a dyspraxic child will have difficulty in planning and organising their thoughts. The following definition by *Contact a Family* (CAF) provides a detailed definition of the dyspraxia.

Dyspraxia is a developmental disorder of organisation and planning of physical movement. The essential feature is the impairment of motor function that significantly interferes with academic achievement or activities of daily living, and is not due to a general medical condition such as cerebral palsy or muscular dystrophy. (CAF, 2002, p137)

DCD/Dyspraxia is a complex condition with various signs and symptoms affecting every facet of children's lives. Although there is no known cause of dyspraxia, it is thought to be immature neuronal development rather than brain damage (based on the Dyspraxia Foundation, 2003). Figures one and two (below) depict this aspect.

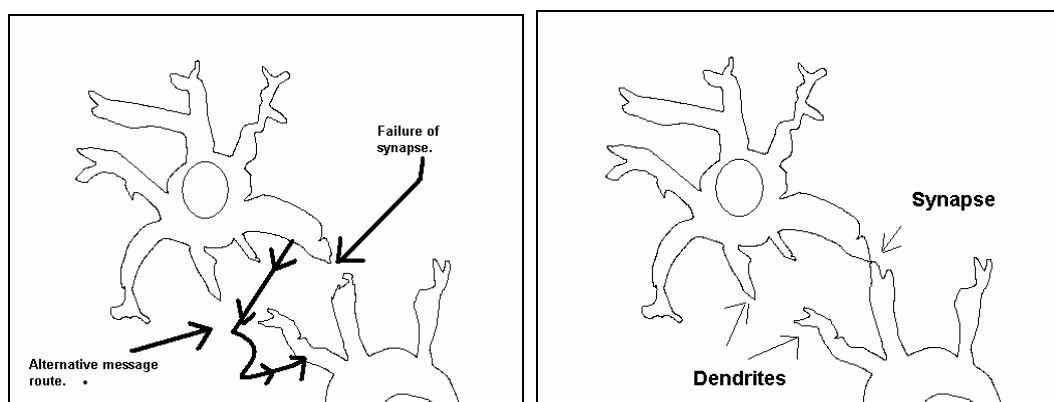


Figure One – Normal synaptic transmission (based on Kalat, 1995a)

Figure Two – Failure of synaptic transmission (based on Kalat, 1995a)

Figure One (above) highlights the correct synaptic connection that is required in normal brain development showing transmission of a message at the synapse and the meeting of dendrites from one cell to the next. In Figure Two (above) it is clearly depicted that the under-connection of the dendrites results in a failure of the synapse. As a result, an alternative route for the message is attempted. It is

this failure at the point of communication between the two neurons (Kalat, 1995b) that is suggested to be the immaturity in brain development that causes dyspraxia (Discovery Centre, 2003).

Although society has decided upon a label, the pathological bases of dyspraxia are still somewhat unclear from the literature available on the subject (e.g. Boon, 2001; Lowe, 2001). It may thus be assumed that different factors create a generally similar condition in different individuals. Other theories that have emerged as to the causes of dyspraxia include the possibility of minor brain damage occurring due to a lack of oxygen, poor circulation, viral infections, intra uterine growth difficulties, alcohol abuse or poison from some form of toxin, which in turn has a direct impact on areas in the brain responsible for motor activity (Portwood 1999). Alongside the above theories about the impact of environmental conditions on the foetus, Portwood (2000) states that a genetic link exists and indeed posits that between 25-40% of people with these problems have inherited them. Macintyre (2000) researched another factor, which can be considered to impact on motor difficulties. She followed up extremely low birth weight babies and the results showed that many of the babies displayed mild and specific learning difficulties, especially motor difficulties. The aforementioned research that has emerged which considers the basis of motor difficulties highlights the issues in searching for a causal link, but for the majority people who have these difficulties, its origin will remain uncertain.

To outline the condition of dyspraxia is problematic. There are many definitions that take a reductionist view to a complex disorder, and these must be expanded and extended to fully encompass the heterogeneous group of individuals who have dyspraxia. An area where difficulties can occur is in the perception of sensory input, or the organisation of balance or fine movements; mechanisms such as those establishing symbolic or kinaesthetic memory can also be impaired (Ripley, Daines, and Barrett, 2003). Indeed some of these difficulties can appear on their own, or co-exist with motor problems the individuals may have.

What all clients with Dyspraxia have in common is a deficit in motor planning that results in motor clumsiness. (Lee and French, 1995, p.98)

A disorder of the higher cortical processes involved in the planning and execution of learned, volitional, purposeful movements in the presence of normal reflexes, power, tone, co-ordination and sensation. (Miller 1986, p. 83)

There is differing opinion as to exactly how many children experience dyspraxia or DCD. The Dyspraxia Foundation (1999) places the figure at 1% to 2% whilst Ripley (2001) hypothesises that the figure may be closer to 5%. Children with DCD will often initially present, particularly in the early years, with a language difficulty (due to poor control of the small muscles in the mouth, Macintyre, 2000). The child will later be perceived as 'clumsy' and may also display temper tantrums or delayed speech. Children who go on to be diagnosed as dyspraxic may also have poor balance, which can show, through frequently falling. Difficulties can occur in reading, writing or dressing and the child may be slow to establish laterality e.g. handedness for writing (Stein, 2003). Behavioural difficulties, as stated above, are also likely to occur in forms such as clowning, stealing, destructiveness, school refusal and being prone to accidents. This is the result of the child developing with the difficulty (Dyspraxia Foundation, 1999).

For the purposes of this report, the terms dyspraxia and DCD will be used in a general sense and will refer to Motor Coordination Difficulties (MCD). In the introduction section the term that is used will usually represent the language that is used in the peer reviewed article that is being discussed.

Moderate Learning Difficulties and Motor Difficulties

In the UK prior to the Education Act (1981) children diagnosed as having Moderate Learning Difficulties (MLD) were described in England and Wales as being *educationally subnormal (moderate)*, whilst in Scotland the term *mentally handicapped* was more common, and in the USA children with similar difficulties were referred to as *educable mentally retarded* (Fox, 2002).

The question as to whether or not children with MLD type difficulties also have motor coordination problems as a result of their condition and therefore cannot benefit from an intervention programme that is designed to improve motor coordination is somewhat of a moot point.

On the Test of Motor Impairment 50 per cent of 8 year-olds and 29 per cent of 12 year-olds had motor problems as compared to 5 per cent in a normal population. (Sugden and Wann, 1987, p. 225)

It can be postulated from the above study that within the MLD population there is a group of children who have severe motor coordination difficulties, which may be a result of the comorbidity that appears to exist between several of the neurological conditions e.g. dyspraxia, ADHD, dyslexia etc (Herbert, 2003). The question regarding improvement possibilities may hinge upon two questions. The first is whether the motor coordination difficulties are a result of a specific neurological disorder such as cerebral palsy where there is definite neurological damage (Portwood, 2000). The second being if the motor coordination difficulties are a result of an immaturity of the brain that affects,

...the receiving and passing on of messages to and from the brain result in lack of coordination of eyesight and bodily movement, and sometimes cause speech disorders. (Boon, 2001, p.17)

If the latter situation were the case with regards to children who have dyspraxic type difficulties then it would make logical sense to presume that a motor coordination improvement programme may, potentially, offer the possibility of the amelioration of some coordination difficulties.

Handwriting

It has been widely reported that children with dyspraxia have difficulties in the area of handwriting (e.g. Portwood, 1999, 2000; Boon, 2001; Miller, 1986). Considering that handwriting is an essential skill for the majority of pupils in education, a child who is experiencing grapho-motor difficulties may find difficulties in expressing, communicating and recording ideas as well as for educational achievement (Wallen, Bonney et al. 1996). Furthermore, a pupil who is slower at handwriting than his or her peers may avoid handwriting; have feelings and fear of failure, thus resulting in low self-esteem and possibly behaviour difficulties (Feder, Majnemer and Synnes, 2000).

Handwriting, as a task, requires a high-level of coordination and high-precision force regulation and it should of no surprise that children with motor coordination difficulties often report handwriting difficulties (Smits-Engelsman, Niemeijer, and Galen, 2001). Various programmes have been introduced in order to assist the child with motor coordination difficulties (Portwood, 1999; Ripley 2001; Reynolds, Nicolson and Hambly, 2003). Fine-motor skills are targeted in these programmes and it follows, therefore, that handwriting would be a focal point for improvement. Sequencing difficulties and short-term memory difficulties can quite often exist with children who have dyspraxic type difficulties (Kirby, 1999). A programme that could improve the speed that a child is able to take notes in his/her jotter would be beneficial in the educational setting as the child would have the opportunity to be closer to the speed of his/her peers.

Programmes of Intervention Involving Physical Activities

Physical activities that improve learning in the classroom have become commercialised and there is quite often a new *fad* that offers instant cures for all ills (e.g. Snowling and Hulme, 2003). Programmes such as *Brain Gym* reputedly improve thinking and learning skills by increasing the amount of movement and thus neuromuscular routes that can improve cognitive skills (Hannaford, 1995). The theory that learning is not all in your head could still be described as being alien to many educationalists despite theories such as Gardner's Multiple Intelligences (Gardner, 1999). The concept of learning and thinking processes being related to kinaesthetic tasks as much as that of *brain power* is not widely held in today's educational programmes (Hannaford, 1997). Different learning styles can include children who learn by movement and these are the same children who may struggle in the traditional classroom where they are lectured to, without the level of interactional activities that stimulate that particular person's idiosyncratic learning style. The point that is being made is that there is evidence that movement can affect learning and there is a symbiotic relationship between both aspects (e.g. Lee, Yoxall, and Smith, 2002; Lee and French, 1995). It makes logical sense that motor coordination difficulties would affect a child's skills in the area of reasoning and sequencing (e.g. Lee and Smith, 1998; 2002). It follows, therefore, that a programme of motor skills improvement would benefit the child in tasks such as handwriting.

Not all programmes based on movement stand up to scientific scrutiny. The DDAT exercise programme (Reynolds, Nicolson, and Hambly, 2003) was reported in *Dyslexia* as being conclusive proof that by following a programme of motor exercises a child with conditions such as dyspraxia,

dyslexia, and/or ADHD maybe able to demonstrate dramatically ameliorated symptoms. Whilst these claims may or may not be accurate, the article received vociferous articles (also in *Dyslexia*) suggesting that there was absolutely no scientific evidence for these claims and also citing major methodological flaws in the original article (for a detailed discussion see Snowling and Hulme, 2003). It should be noted that these criticisms were refuted in a later article (see Nicolson and Reynolds, 2003).

This study is designed to investigate the efficacy of a motor skills training programme for young people with moderate learning difficulties. The guiding hypotheses are that through this programme the children will improve their speed of handwriting and also their general gross motor coordination.

Method

Design

The main element of this study was to attempt to offer quantifiable evidence as to whether or not an intervention programme designed for children with dyspraxic type difficulties in a school for children with Moderate Learning Difficulties (MLD) could benefit the participant children. The fundamental principles underlying this study are based on the intervention model proposed in Portwood (1999). It should be noted, however, that the aforementioned intervention programme was designed primarily for children in mainstream education. An extensive search of the available literature did not highlight an appropriate intervention programme for children with moderate learning difficulties. There were different components involved in the intervention programme and it was deemed appropriate to describe each part in turn.

Motor Skills Screening

It would have been laborious to screen every pupil in the school; therefore it was deemed appropriate that the Head of Physical Education would put forward a selection of pupils that were thought to be exhibiting the most obvious motor difficulties. Mynard and Joseph (1997) report on the role of physical education teachers to identify children with Developmental Coordination Disorder.

The Head of PE, author of this paper, and a Chartered EP acted as a Scoring Group (SG) and used a checklist (Portwood, op. cit.) to record behavioural characteristics that may indicate Motor Coordination Difficulties (MCD). The screening session took place in the school gymnasium. These are outlined in the table below.

Table 1 – Motor Screening. Based on Portwood (1999, p55)

Item	Behavioural Characteristics (indicating MCD)
Walking on toes forwards and backwards.	Hands bend in at the wrist away from the body.
Walking on heels forwards and backwards	Arms held upwards from the elbow.
Walking on insides of feet	Arms extend behind, hands bend turning away from the body.
Walking on outsides of feet	Arms bend outwards and wrists turn in.
Recognising fingers touched when obscured from view.	Child is consistently unable to identify the correct fingers.
Finger sequencing.	Associated or mirror movements in the hand that is relaxed.
Wrist rotation.	As the child rotates his/her wrists the elbows are moving outwards.
Balancing on each foot.	Child's arms will be moving around as well as hopping as the child attempts to correct him/herself.
Touching end of nose with index finger of each hand (eyes closed).	Child is unable to locate nose with the single finger but may try to do so with the whole hand.
Jumping: feet together.	Elbows may be held tightly into waist with fists clenched.

Each member of the SG recorded on the checklist whether the observable behavioural characteristics were evident. At the completion of each subject's screening each member would state whether they categorise each subject into one of three groups (see full description in the Subjects subsection).

Baseline Measurements (Motor Assessment)

In order to measure the subject's progress on the programme it was decided that a pre and post videoing session of the baseline assessment would afford an appropriate measure of progress. The baseline motor assessment would cover the following areas:

- Crawling
- Balance (both left and right)
- Parallel lines
 - Soles – heel/toe
 - Toes – Walking on
 - Heels – Walking on
 - Side Steps
- Running
- Jumping
- Hopping (both left and right foot)
- Rope Turning (both left and right hand)
- Clapping
- Finger Sequencing (both left and right hand)

Videoing would take place of the subjects in Group One before the programme took place so as to ascertain the baseline measurement. On completion of the programme a post-test videoing session would also take place

Baseline Measurements (Handwriting)

The speed of a pupil's handwriting is an important factor in most facets of the education system including that of the MLD sector. Following on from this aspect it was deemed beneficial that a pre and post measure of handwriting be carried out (Schneck, 1998). For this purpose the *Handwriting Speed Test* (Wallen and Bonney et. al., 1996) was used. It was envisaged that, as per the guiding hypothesis, that handwriting speed would improve in Group One children after completion of the intervention programme. The controls (Group Two) would not be expected to differ in any significant way from their pre and post scores. The test consisted of the subjects having to write, *the quick brown fox jumps over the lazy dog*, as many times as they can in three minutes. The test was administered by the author and took place in a suitable room within the school, with each subject being administered separately. The pre-tests were carried out in late January 2003 and the post-tests in mid-June 2003.

Intervention Programme

Subjects in Group One were to take part in the intervention programme, which would last a total of eighteen weeks (not including school holidays). The eighteen weeks were split into three six-week blocks with the middle block being a period where the programme was not run as per Portwood (1999). The programme would be run for a period of approximately ten to fifteen minutes every school day. The optimal time that would minimise disruption to the subject lessons was deemed to be during the registration period, which was first thing every morning.

In order for the intervention programme to be effectively aimed at the participant subjects it was necessary to select exercises that would benefit the group based on their identified needs. Portwood's six categories each had many exercises and the appropriate exercises for the subject group are listed in Table 2 below.

Table 2 – Exercise Programme

Category	Activity
Finger, Hand and Arm Movements	Marble Manipulation
Foot Eye Co-Ordination	Hopscotch
Foot Eye Co-ordination	Heel to toe (forward and backward)
Foot Eye Co-ordination	Heel to toe – following contours of skipping rope
Balance	Beam Walking
Hand Eye Co-ordination	Bean Bags into Basket
Whole Body Co-ordination	Jumping into Hoops

There were three members of the school staff who were responsible for running the programme each day. These were the Head of Physical Education, the Janitor, and the Auxiliary. The latter two were utilised so as to minimise the disruption to the school timetable that would have resulted if teachers were required to leave their classes.

Staff Questionnaire

It was deemed appropriate that feedback should be sought from the three participant staff members. For this purpose a questionnaire was designed by the author and was administered on a one-to-one basis with the author filling in the questionnaire from the verbal feedback given by the member of staff. The question areas are detailed as follows:

- In your opinion, do you think that the motor co-ordination improvement programme has benefited the children?
- What were the strengths of the programme?
- What were the weaknesses of the programme (and details)?
- If the programme was to be run again what improvements would you make in order to ensure the smooth operation?
- Did you think that the programme was worthwhile?
- Other comments.

Subjects

Initially the Head of Physical Education who, in her professional opinion, thought that the selected group of eighteen might be exhibiting some signs of Motor Co-ordination Difficulties (MCD) selected the subjects who would be put through the motor skills screening programme (this technique was also used by Piek, Dworcan, Barrett, and Coleman, 2000). This group of pupils originally selected by the PE teacher would be separated into three groups as follows:

- Group One – *Subject is exhibiting severe MCDs and would therefore benefit from the intervention programme.*
- Group Two – *Subject is exhibiting some MCDs but they are not regarded as severe enough to be Group One status. Subjects in this group may be offered an intervention programme in the future.*
- Group Three – *Subjects are exhibiting no evidence of MCDs or that the subject obviously has some other medical condition thus affecting his/her motor co-ordination (e.g. cerebral palsy).*

The subjects who are categorised as being in Group One were thus identified as being suitable for the intervention programme. Subjects categorised as Group Two would be used as a control group for the purpose of measuring handwriting speed differences. The Scoring Group (SG) decided, based on the afore-described checklist that six pupils could benefit from the intervention. This informed the research design therefore not enabling equivalency in the experimental group and the control group in that the latter had markedly less MCD. Table 3 below classifies the subjects by their group.

Table 3 – Subject Details

Subject Number	Group	Age
One	One	12
Two	One	12
Three	One	13
Four	One	14
Five	One	14
Six	One	14
Seven	Two	12
Eight	Two	11
Nine	Two	12
Ten	Two	13
Eleven	Two	14

Results

Handwriting Component

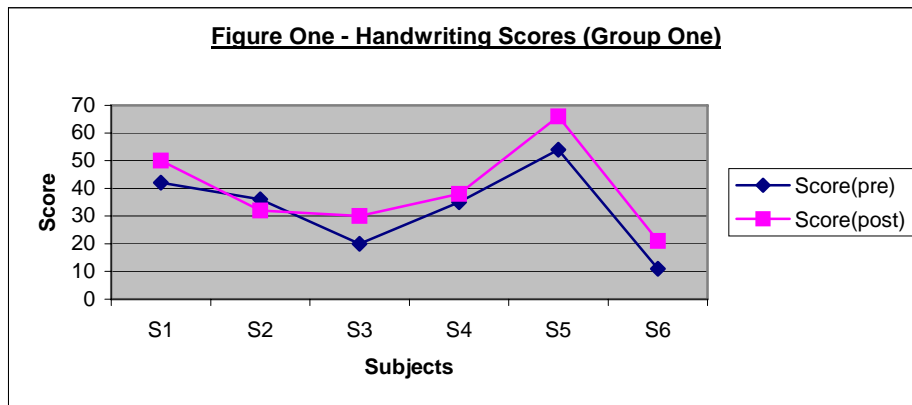


Figure One illustrates that five out of the six subjects have made gains on their pre-scores in Group One. In contrast, as Figure Two (below) depicts, Group Two subjects have remained fairly constant with their scores either improving or decreasing slightly.

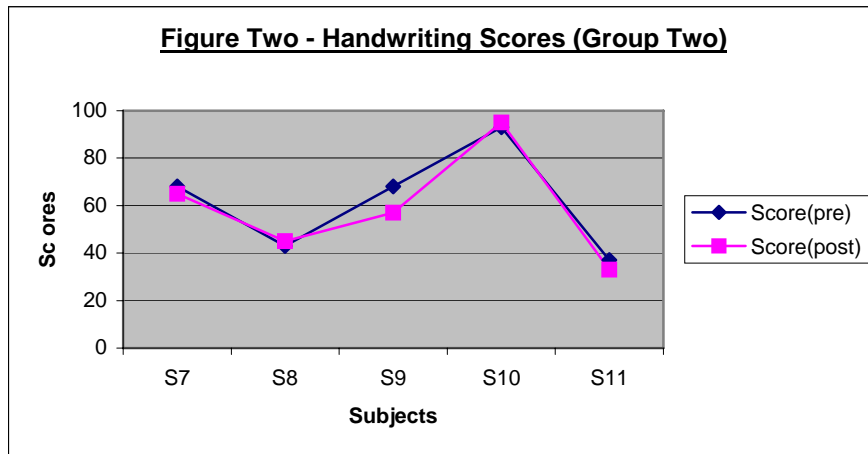


Figure Three highlights and Table Four details the results of the mean differences between the groups for the two tests combined. It can be clearly seen that the Group Two scores show little variation whereas the Group One scores illustrate an important rise. The latter group indicated a rise in speed of 6.5 points whilst the former group indicated a drop in speed of 2.8 points. It is apparent that in considering the *percentage difference* it can be seen that certain subjects in Group One have made noteworthy gains. Group Two, by contrast, appear to have either remained relatively static or made losses in the speed of their handwriting.

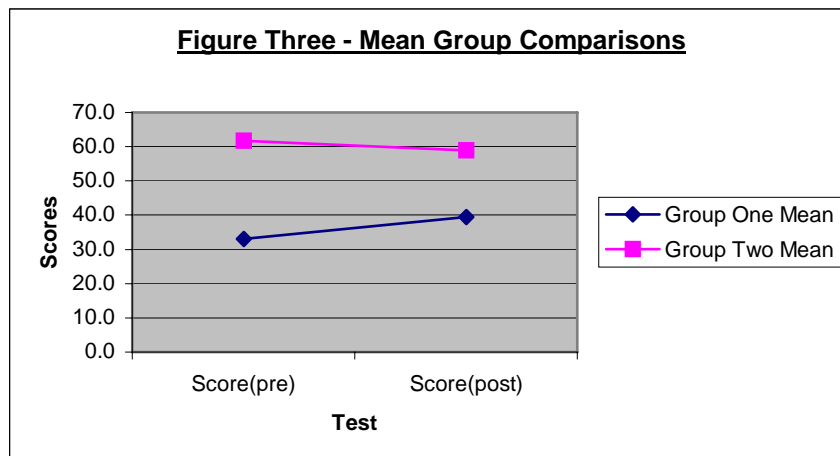
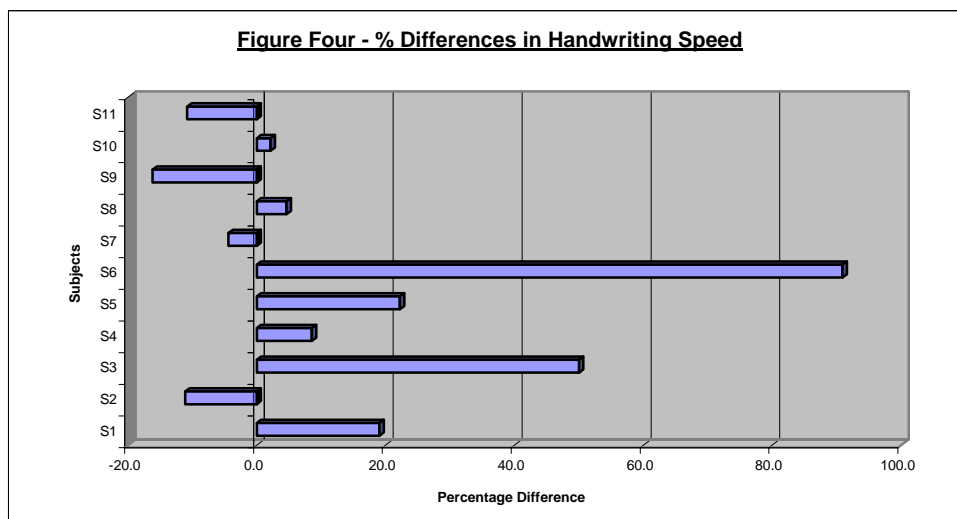


Table Four – Mean Group Differences for Speed of

group		pre-test handwriting	post-test handwriting	handwriting differences
1	Mean	33.00	39.50	6.50
	N	6	6	6
	Std. Deviation	15.41	16.15	5.99
2	Mean	61.80	59.00	-2.80
	N	5	5	5
	Std. Deviation	22.47	23.49	5.36
Total	Mean	46.09	48.36	2.27
	N	11	11	11
	Std. Deviation	23.39	21.33	7.28

As has been aforementioned there are distinct handwriting speed differences between Groups One and Two. This is lucidly depicted in Figure Twelve wherein the percentage differences are the focal point of the graph. Percentage score increases of over 50% and 90% in Group One provide for interesting analysis.



A one-way Analysis of Variance (ANOVA) was used to show the difference between groups in pre and post self-esteem scores and also to observe if pre and post change is different between groups. A summary of the statistical findings is detailed below.

- There differences between the groups with regard to handwriting scores at the pre-test component were significant at $F=6.35$ ($df=1, 9$) $P<0.05$
- The post-test handwriting scores were not significant at $F=2.66$ ($df=1,9$) $P<0.137$
- Overall handwriting speed differences between groups has been classified as a significant result at $F=7.21$ ($df=1,9$) $P<0.05$. This result indicates that Group One has made significant gains in their handwriting speed over the period between the pre and post-tests.

Video Analysis Component

Table Five - Amount of Correctly Identified Pre and Post Test Sequencing

Component	Pupil 1	Pupil 2	Pupil 3	Pupil 4	Pupil 5
Running	1	3	0	5	1
Finger Sequencing	5	6	6	2	3
Rope Turning	6	2	7	2	2
Following a Line	6	6	5	5	4
Balance	3	6	2	6	6

Total:	21	23	20	20	16
Total % Correct	60.0	65.7	57.1	57.1	45.7

Table Five indicates that overall the Video Review Panel (VRP) felt that four out of the five subjects had made noticeable improvements in their motor coordination. The percentages are not higher because the VRP did not see improvements in some activities. The case-in-point being the *Running* Component where overall the subjects did not appear to have improved their motor co-ordination in that respect. Conversely, the *Following a Line* component seemed to indicate that obvious improvements were noted by the VRP across all subjects. The range of the total percentage scores ranged between over 45% to over 65% thus suggesting that each pupil has made obvious improvement in certain components but not in others.

Qualitative Feedback from Participative Staff via a Questionnaire

This subsection will highlight principle comments that have been taken from the questionnaires. The format for this subsection will detail relevant answers to questions and will be organised by question.

1. *In your opinion, do you think that the motor co-ordination improvement programme has benefited the children?*
 - Yes. You can see the difference from the start right through to the end.
 - Most definitely. I was amazed at one pupil in particular.
 - It appears to have benefited the children especially one pupil whose movements were all over the place. Movements are refined in these exercises.
2. *What were the strengths of the programme?*
 - You did not need to use teachers; senior pupils and non-teaching staff could be used.
 - Equipment that was required to be used was already there i.e. no extra expenditure was required from the school.
 - The school management team supported the programme.
3. *What were the weaknesses of the programme (and details)?*
 - There was not enough training regarding what behaviours we were meant to alter. Ongoing or refresher training may have assisted in this regard.
 - The programme lasting six-weeks at a time was a long time for the pupils, as they were getting fed-up.
 - There was no incentive for the children to finish the programme – rewards would have helped them to maintain interest.
4. *If the programme was to be run again what improvements would you make in order to ensure the smooth operation?*
 - Assigning two pupils for each member of staff to work with. You could, therefore, build up a rapport within small groups and that you would know your pupil.
 - Some sort of merit award should be awarded to as to show that the pupils have worked on the programme.
 - Connect programme into school rewards system – something to motivate the pupils.
5. *Did you think that the programme was worthwhile?*
 - Yes. When you see the differences in co-ordination outside the gym.
 - Seen improvement in one pupil. He does not have his finger in his mouth and now he makes eye contact whereas before there was very little.
 - Yes, because you can see the difference in the pupils. It would be good to see the programme running again with new pupils.
6. *Other Comments*
 - Even if only one or two pupils were helped then it is worthwhile.

- It would have been beneficial to measure the improvements by way of a pre and post test of general PE ability e.g. in the natural environment whether it be in a game of basketball or other sport.

Notwithstanding the comments regarding improvements and weaknesses, there appears to be strong qualitative evidence that overall the programme has been successful in some ways, not least the improvements that some children appear to have made vis-à-vis concentration and eye contact. Despite the fact that the sample size was somewhat on the small side, the comments from the interviewees seems to be fairly concordant in that they felt that there was a lot of positivity from the programme and this can only assist the project school.

Discussion

Results Analysis (Speed of Handwriting)

Handwriting is an essential skill in the educational setting (Wallen, Bonney, and Lennox, 1996) and if the speed of a child's handwriting is relatively slow, then it follows that the amount of information that can be written down e.g. in a jotter, under direction from a teacher is somewhat limited. Vital pieces of information could be missed as the child is continually attempting to *chase the task*. The subjects in Group One made a significant improvement in their handwriting during the period of the intervention programme. Fine motor skills improvement was mentioned in the literature (Portwood, 1999; Kirby 1999) as being a possible area of improvement after a physical exercise intervention programme. The results from this study certainly appear to support those findings especially when the scores of group one and two are compared. The latter group (controls) showed no significant levels of improvement, whereas the former group displayed significant levels of improvement in every pupil, bar one.

A more crude measure of improvement but, however, still illustrative of the level of enhancement of the Group One subjects, was that of a subject-by-subject percentage improvement analysis. The fact that the experimental group had four from six subjects achieving improvements ranging from almost 20% to 90% is at the very least requiring further analysis. This would enable the intervention programme to be more tailored to individuals within the programme. The control group only made slight gains or slight losses, in effect indicating that there was no significant difference, with regards to speed of handwriting, in the control group during the duration of the intervention programme. When the level of significance of the Group One result is considered, it would be fair to infer that the intervention programme seems to have improved the fine motor skills at least with regards to handwriting speed.

It was hypothesised that *children who appear to exhibit MCD have poor handwriting skills also*. From the results analysis there seems to be little doubt that within the population of the project school the handwriting skill of the pupils is poor. This hypothesis is supported and what the results have conclusively revealed is that MLD pupils can be helped to improve their handwriting speed with a simple intervention programme that does not interfere with the curriculum of the pupils.

Results Analysis (Video Component)

The results of the Video Review Panel (VRP) indicated that the subjects had an observed improvement rate of between 45% and 65%. Notwithstanding the fact that the results taken from the VRP observations were not scientifically analysed, the findings are still worthy of comments. It was deemed, by the author of this report, appropriate that this analysis was included within this report, as it would provide a tangible and usable component for the school, in that they would be able to see concrete improvement in the pupils. The professionals involved in the running of the intervention programme noticed improvements in the pupils during the pre and post testing of the baseline measurements. In order to ensure inter-observer reliability (Robson, 1993) it was decided that it would be necessary for a group of independent observers to watch the video of the pre and post-tests. The VRP found that improvement was evident in certain components and not in others, so that the running element, for example, was least useful for affecting change in the subjects. In stating this, however, it should be noted that each exercise could not be expected to benefit every child in the group due to the differences inherent in each individual, therefore it could be postulated that achieving a higher percentage score may not have been particularly realistic.

Analysis from the video, whilst not a perfect measure due to the inevitable subjectivity, indicates that the individual children have benefited from the intervention programme in that certain necessary skills have been improved upon. Whilst not every subject has benefited in every area, it would still be

acceptable to state that overall the subjects have shown signs of improvements in both gross and fine motor skills. These independent results from the VRP give credence to the anecdotal evidence from the professionals involved that improvements had taken place in all of the children some of the time but probably not in all of the children all of the time. The evidence to support the perceived visualisations of improvements will make the worthiness of the programme easier to justify to the project school and other establishments, who may be interested in instigating an intervention programme of this kind in either a mainstream or a special school in the future.

Results Analysis (Qualitative Feedback – Staff Questionnaire)

The overall picture from the participant staff was that this programme was extremely worthwhile and that all three staff thought that the motor coordination improvement programme benefited the children who were involved. It was felt that you could notice improvements from the beginning to the end and that some of the individual improvements that several of the children made are noteworthy.

The programme was specifically designed, in conjunction with the school, so as to minimise the amount of teaching staff that would be required to operate the programme. If an intervention programme is demanding upon teaching time then, in the experiences of the EPiT, the programme will quite often fall away or run once and then be shelved. A definite strength of this intervention was that it did not demand a lot of teaching time nor did it require pupils to be removed from the class. Conducting the programme during registration ensured that disruption was kept to an acceptable minimum and was more likely to be viewed as complimentary to the education of the pupils as opposed to having a deleterious effect. Another factor that obviously has an effect upon the successes or failures of a project is that of cost to the school. In the case of this programme, the financial cost to the school was nothing as the equipment was already held within the school. On being asked if the staff thought that the programme had been worthwhile, all three answered *yes* to this question. Staff have noticed improvements in areas such as concentration, coordination outside of the gym, and making eye contact. There seems, therefore, to be evidence that there are tangible gains that have been seen by members of staff without the need for statistical analyses to provide a quantitative verification of improvements due to the programme. Again, it is important to emphasise that it is necessary for the school to be able to see clear improvements for a programme of this type to be afforded the necessary kudos that will allow it to take root in the school. Statistical analyses are relevant in certain quarters but on occasion they do not necessarily help a school make up its mind about the potentiality of a programme.

Reflections and Areas for Improvement vis-à-vis the Intervention Programme

When it was decided that the aforementioned intervention programme was the most appropriate way forward in addressing the needs of the school, an INSET was provided for the school staff on the topics of dyspraxia, and the details of the proposed intervention programme. It seems that even though information was provided to the school staff in the initial stages, there was not a lot of extra information provided once the programme was in operation. This could mean that staff were not able to invest in the programme and ultimately it would remain slightly esoteric in that it was a project for a select few operating on the peripheries of the school.

The involvement of non-teaching staff was deliberate so as to minimise the disruption to the school staffing system. There were discipline issues regarding how the pupils responded to auxiliary staff i.e. they were not as responsive as they did not see non-teaching staff as being authority figures. A flaw of the initial staff training was the omission of the auxiliary staff (i.e. staff coaches) from the initial INSET to the teaching staff. This lapse did not affect the ability or the effort from the coaches in carrying out their coaching duties in a diligent manner. It was raised by the coaches that sometimes they were not really sure what behaviours they were looking for, and thus attempting to discourage during the programme. It is possible that a more thorough initial training for the staff, which should be complimented with ongoing or refresher training thus ensuring uniformity of approach from the coaches.

The predominant use of non-teaching staff was, on reflection, an acceptable approach. However, on occasion, a staff member would be called away to attend to other duties, which would mean that there was a reduced amount of staff working through the programme with the children. The continuity and positive relationship that the members of staff would have with their small group would be lost if they are having to leave the children to either work with minimal encouragement or be switched to another

tutor for a longer period of time. Either way, there will probably have been impacts on the children's ability to maximise their programme for that particular day.

Limited generalisability can be taken from this study due to the small sample size involved. However, there is a reasonable amount of evidence to suggest that the results have revealed is that MLD pupils can be helped to improve their handwriting speed with a simple intervention programme that does not interfere with the curriculum of the pupils. A more thorough and rigorous investigation would be warranted to fully explore the effectiveness of a programme of this type.

References

- Boon, M. (2001) *Helping Children with Dyspraxia*. London: Jessica Kingsley Publishers.
- CAF (2002) *The CaF Directory of Specific Conditions and Rare Disorders*. London: Contact a Family (www.cafamily.org.uk)
- Chu, S. (1995) The Diagnosis of Dyspraxia. In The Dyspraxia Foundation. *Children with Developmental Dyspraxia – Information for Parents and Teachers*. Herts: Dyspraxia Foundation.
- Dyscovery Centre. (2003) *Overview. Dyspraxia – Developmental Co-ordination Disorder (DCD)*. Cardiff: The Dyscovery Centre.
- Dyspraxia Foundation. (1999) *Standing On Your Head. Coping With the Behavioural Problems of Children With Developmental Dyspraxia*. Herts: Dyspraxia Foundation.
- Dyspraxia Foundation (2003) www.dyspraxiafoundation.org.uk
- Feder, K., Majnemer, A. and Synnes, A. (2000) Handwriting: Current Trends in Occupational Therapy Practice. *Canadian Journal of Occupational Therapy*, 67(3), 197-204
- Fox, M. (2002) The Education of Children with Special Educational Needs: Evidence or Value Driven. *Educational and Child Psychology*, 19 (3), 42-53
- Gardner, H. (1999) *Intelligence reframed : multiple intelligences for the 21st century*. New York: Basic Books.
- Gubbay, S. S. (1975) Clumsy Children in Normal Schools. *Medical Journal of Australia*, 1, 223-236
- Hannaford, C. (1995) *Smart Moves. Why Learning is not all in Your Head*. Arlington, Virginia: Great Ocean Publishers.
- Hannaford, C. (1997) *The Dominance Factor. How Knowing Your Dominant Eye, Ear, Brain, Hand, and Foot Can Improve Your Learning*. Arlington, Virginia: Great Ocean Publishers.
- Herbert, M. (2003) *Typical and Atypical Development: From Conception to Adolescence*. Oxford: BPS Blackwell.
- Kalat, J. W. (1995a) *Biological Psychology – Fifth Edition*. Pacific Grove, CA: Brooks/Cole Publishing Company.
- Kalat, J. W. (1995b) *Dictionary of Biological Psychology. Fifth Edition*. California: Brooks/Cole Publishing
- Kirby, A. (1999) *Dyspraxia. The Hidden Handicap*. London: Souvenir Press (Educational and Academic Ltd.
- Lee, M., and French, J. (1995) *Dyspraxia: A Handbook for Therapists*. London: Chartered Society of Physiotherapists.
- Lee, M. and Smith, G. (1998) The Effectiveness of Physiotherapy for Dyspraxia. *Physiotherapy*, 84(6), 276-284
- Lee, M. and Smith, G. (2002) A Three Year Study on the Progress of Children Following Physiotherapy Treatment for Dyspraxia. *Dyspraxia Foundation Professional Journal*, 1 (July), 9-23
- Lee, M., Yoxall, S. and Smith, P. (2002) *The Improvement made with Self-esteem Following Physiotherapy Treatment for Dyspraxia*. Poster Presentation at the Dyspraxia Foundation's Annual Conference.
- Lowe, S. (2001) *Developmental Motor Dyspraxia (10 most asked questions)*. Australia Dyspraxia Support Group Website.
- Macintyre, C. (2000) *Dyspraxia in the Early Years. Identifying and Supporting Children with Movement Difficulties*. London: David Fulton Publishers.
- Miller, N. (1986) *Dyspraxia and its Management*. London: Croom Helm Ltd.
- Mynard, H. and Joseph, S. (1997) The Identification of Children with Developmental Coordination Disorder by Class and Physical Education Teachers. *British Journal of Educational Psychology*, 67(1), 55-68
- Nicolson, R. I., and Reynolds, D. (2003) Sound Findings and Appropriate Statistics: Response to Snowling and Hulme. *Dyslexia*, 9, 48-71

- Piek, J. P., Dworcan, M., Barrett, N. C. & Coleman, R. (2000) Determinants of Self-Worth in Children with and without Developmental Coordination Disorder. *International Journal of Disability, Development and Education*, 47(3), 259-272
- Portwood, M. (1999) *Developmental Dyspraxia. Identification and Intervention. A Manual for Parents and Professionals. Second Edition.* London: David Fulton Publishers Ltd.
- Portwood, M. (2000) *Understanding Developmental Dyspraxia. A Textbook for Students and Professionals.* London: David Fulton Publishers Ltd.
- Reynolds, D., Nicolson, R. I., and Hambly, H. (2003) Evaluation of an Exercise-based Treatment for Children with Reading Difficulties. *Dyslexia*, 9, 48-71
- Ripley, K. (2001) *Inclusion for Children with Dyspraxia/DCD. A Handbook for Teachers.* London: David Fulton Publishers Ltd.
- Ripley, K., Daines, B., and Barrett, J. (2003) *Dyspraxia. A Guide for Teachers and Parents.* London: David Fulton Publishers.
- Robson, C. (1993) *Real World Research. A Resource for Social Scientists and Practitioner-Researchers.* Oxford: Blackwell Publishers Ltd.
- Ross, A. (1974) *Psychological Disorders of Children. A Behavioural Approach to Theory, Research and Therapy.* USA: McGraw-Hill Book Company.
- Schneck, C. M. (1998) *Clinical Interpretation of "Test-Retest Reliability of the Evaluation Tool of Children's Handwriting-Manuscript". The American Journal of Occupational Therapy*, 52(4), 256-258
- Smits-Engelsman, B.C.M., Niemeijer, A.S. & van Galen, G.P. (2001) Fine Motor Deficiencies in Children Diagnosed as DCD based on Poor Grapho-Motor Ability. *Human Movement Science*, 20, 161-182
- Snowling, M. J., and Hulme, C. (2003) A Critique of Claims from Reynolds, Nicolson, and Hambly (2003) that DDAT is an Effective Treatment for Children with Reading Difficulties – 'Lies, Damned Lies and (Inappropriate) Statistics?' *Dyslexia*, 9, 48-71
- Stein, J. (2003) Evaluation of an Exercise Based Treatment for Children with Reading Difficulties. *Dyslexia*, 9, 48-71
- Sugden, D. & Wann, C. (1987) The Assessment of Motor Impairment in Children with Moderate Learning Difficulties. *British Journal of Educational Psychology*, 57, 225-236
- Wallen, M., Bonney, M. A., and Lennox, L. (1996) *The Handwriting Speed Test.* Adelaide: Helios Art and Book Co.