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ACADEMIC PERFORMANCE OF CHILDREN WITH CEREBRAL PALSY: A COMPARATIVE STUDY OF CONDUCTIVE EDUCATION AND BRITISH SPECIAL EDUCATION PROGRAMMES

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Introduction

Cerebral Palsy is a neuromuscular dysfunction caused by non-progressive injury to the immature brain and resulting in various impairments of the ability to co-ordinate muscle action to maintain normal posture and movement. Two to three children have cerebral palsy in every 1,000 livebirths (British Medical Association, 1990; Woods, 1957).

The damage can occur prenatally, perinatally or postnatally. Prenatal damage can be caused by maternal hypertension with vasoconstriction, placental insufficiency and severe cardiovascular complication, drug and alcohol consumption and maternal infection such as rubella during pregnancy. Perinatally acquired cerebral injuries can result from prolonged or precipitous labour, umbilical cord compression, metabolic or blood diseases. Postnatally acquired injuries include head trauma, vascular accidents, meningitis, poisoning or illness, accidents and haemorrhage in early life. Prematurity (birth weight about 1,500g) is the most single contributory factor to cerebral palsy (Molnar, 1985).

Even though there are no universally agreed standards of classification of cerebral palsy (Gans and Glenn, 1990; Evans and Albertman, 1985) the following are most commonly used in the literature:

If neurological signs are presented to one side of the body, the condition is termed hemiplegia. When the neurological symptoms are more pronounced in the legs than the upper limbs, it is termed diplegia. If all four limbs are involved, it is called tetraplegia or quadriplegia.

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Different terms are used to describe the characteristics of motor dysfunction. Spasticity is the most common type of cerebral palsy which occurs due to damage of the cerebrum. The cerebrum is responsible for the initiation and coordination of voluntary activity in the body (Gans and Glenn, 1990). The spastic type of cerebral palsy is characterized by increased muscle tone and stiffness (Molnar, 1985). Athetosis and ataxia are due to impairment of the basal ganglia area. The neurons in the basal ganglia area are responsible for tone and posture (Molnar, 1985). Athetosis is characterized by excessive movements, disturbance of posture and inability to use hands and to speak. Woods (1957) describes athetosis as slow, writhing and muscular contractions when a child is attempting any voluntary movement. Ataxia is characterized by shaky movement and unsteady gait. There are mixed types of cerebral palsy. Mixed type referes to combination with more than one condition such as quadriplegia in spastic athetoid type (Molnar, 1985).

Many children with cerebral palsy have other disabilities in addition to neuromuscular dysfunction. About 40%-60% of cerebral palsied children have learning difficulties, approximately 50% of the children have seizures, about 20%-60% of them have visual and perceptual problems. Many of them have speech and developmental language disorders and hearing deficits (Woods, 1957; Molnar, 1985).

Various methods and techniques have been developed and used to manage children with cerebral palsy. Surgery, splints and orthoses are used to prevent or to correct deformities. Drugs have been used to reduce spasticity on a temporary basis. Different types of physiotherapy have been used to rehabilitate children with cerebral palsy, such as the neuro-developmental approach, the neuromuscular facilitation method, and progressive pattern movement, as well as biofeedback and behaviour modification techniques.

Conductive Education is an educational system combined with therapeutic and rehabilitation components. During the 1940's Andras Petö, a physician in Hungary, developed Conductive Education for children and adults with motor dysfunction. The conductors who deliver the education programme combined several roles such as teacher, physiotherapist, occupational therapist and nurse. The practice does not use sophisticated modern equipment, employing instead simple ladderback chairs and plinths. Orthoses and mechanical aids, such as wheelchairs, communication aids and other adapted materials are rarely tolerated.

"Orthofunction" seems to be one of the most important criteria for graduation from Conductive Education. However, there is no clear definition of orthofunction (Bairstow *et al.*, 1993). It seems to refer to the ability to control bladder, impulse, dribbling, attention-span and to achieve self-sufficiency in daily living activities within a normal environment, such as mainstream school. There is great emphasis placed upon the ability to move around a normal environment unaided.

Group plays an important role in Conductive Education. Emphasis is placed on the function of the child in the group situation and effect of the group on the child. The children are normally grouped together according to age, categories of disability, such as cerebral palsy or spina bifida and ability.

Rhythmic intention is well incorporated in the programme. Conductive Education incorporates singing and rhythmic activities in the programme of physical exercises. The vocalization or singing describes the movement being presently performed or to be performed. For example, "I stretch my legs; one, two, three", and so forth.

The programme is very intensive. The children are busily involved in various activities all day without much free time. Children's self-motivation or achievement orientation is greatly emphasized. The children are admitted to the programme from the age of three.

During the 1980's the British mass media publicized the success of Conductive Education in Hungary and attracted the attention of many parents of children with cerebral palsy in the UK. In response to parental pressure the Foundation for Conductive Education, a national charity, was established and imported the Conductive Education system to Britain through the medium of the Birmingham Institute for Conductive Education. The Birmingham Institute has been in operation since September 1987 and aims to provide Conductive Education for children with cerebral palsy and to train British school teachers as conductors applying the principles and methods of Conductive Education.

The aim of the study

The aim of the study was to evaluate differences in academic performances of children who were enrolled in Conductive Education in Birmingham and children who were enrolled in alternative special education programmes in the Greater Manchester area.

It was hypothesized that the children in alternative special education programmes would perform better in the academic domain while children in Conductive Education would make more rapid advances in the physical domain. This was because the two educational programmes appeared to be distinctly different in their emphasis: the traditional British special education programmes seemed to focus more on the academic domain while Conductive Education seemed to concentrate more on the physical domain (e.g. the children spent more time on physical exercise, walking practice, sitting and lying, changing positions etc.).

Method

Subjects

The subjects were 36 children with cerebral palsy (see TABLE I). Nineteen were enrolled in the Birmingham Institute for Conductive Education and 17 were attending special schools for

TABLE I
Subject's Characteristics

Variables	Children in Conductive Education (N = 19)				Children in Comparison Group (N = 17)				Significance		
									Group	Time	G x T
IQ	Time 1 Mean 85.5	Time 2 Mean 84.1	Time 3 Mean 81.9		Time 1 Mean 83.2	Time 2 Mean 88.6	Time 3 Mean 85.2		ns	ns	ns
Self-Help Age Differential Score	Mean -25.8				Mean -25.0				t = .0075 ns		
Severity of Handicapping Condition	Frequency Severe 10	Moderate 4	Mild 5		Frequency Severe 6	Moderate 6	Mild 5		$x^2 = 2.64$ ns		
Parental Social Class	Frequency 1 & 2, 8	3M & 3N, 4	4 & 5, 2	Unemployed 5	Frequency 1 & 2, 5	3M & 3N, 5	4 & 5, 3	Unemployed 4	$x^2 = .009$ ns		

Social Class 1 and 2 = Professional and intermediate occupations
Social Class 3M and 3N = Skilled manual and skilled non-manual occupations
Social Class 4 and 5 = Semi-skilled and non-skilled manual

Classification of Occupation and Coding Index (1980) children with physical handicaps in the Greater Manchester area. Their age range, at the time of the first assessment of academic attainment, was 5 years to 6½ years old. The mean IQ for the Birmingham group was 83.5 and for the Manchester group was 85.1. Of the 19 children in Birmingham, 10 were boys and nine were girls. Of the 17 children in the Manchester group, five were boys and 12 were girls. The Research Team had no control over the selection of the Birmingham group. Therefore, random selection and random assignment were impossible. The two groups were closely matched on a range of physical, social and functional variables (see Bairstow *et al.*, 1993).

Experimental Design

The study employed a two-by-two factorial design with repeated measures on one factor. Factor 1 is Groups with two levels, Birmingham (Conductive Education) and Manchester (Special Education) and Factor 2 is time (year 1 and year 2).

The Measuring Instruments:

The Reading and Mathematic Tests were designed for use with children with cerebral palsy, aged 5 to 8 years. Some of the content of the test was extracted from various standardized and criterion referenced tests (Hagley, 1986; Lumb and Lumb, 1987) and modified so that children who are limited physically, verbally, or both, can respond to the test items. The two tests were developed by consulting various educationalists.

Many existing tests are designed for a non-disabled population. Therefore, they are often not suitable for children with multi-handicapping conditions. The instructions for the tests employed, the materials used and the multiple-choice formats permit physically and verbally disabled children with cerebral palsy to respond and demonstrate their academic attainment without penalising their performance. The attainment scores have been shown to be highly correlated with other test scores such as Pictorial Test of Intelligence (French, 1964) and Academic Age Scale of Developmental Profile II (Alpern *et al.*, 1986).

The Comprehensive Reading Test (CRT)

The CRT has two components: pre-reading and formal reading. The pre-reading section is designed to measure the codes and prerequisites skills which are essential for learning the basics of reading and spelling.

The pre-reading section includes Visual Sequential Memory (8 items), Individual Letter-Sound Recognition (26 items) and Recognition of Capital and Lower-case letters (13 items).

The formal reading section has two parts; Phonetically Regular 2-3 letter word recognition which is aimed to assess the ability to generalize phonic rules (15 items) and grammar and sentence completion (20 items). This subtest is designed to measure knowledge of English grammar and sentence comprehension. Part of the Suffolk Reading Scale (Hagley, 1986) has been adapted for children with cerebral palsy. The child is required to choose the right word among five words to make a complete sentence. To do this, the child should be able to recognise the meaning of the word, the context of the sentence and grammar. The test items are presented visually. That is, the tester does not read the sentence to the child. The CRT has a total of 84 items.

The material for each subtest of the reading test consists of a series of stimulus and response cards. Each response card contains one, two or three line drawings, letters, words or sentences. The questions are presented orally by the tester, except for the grammar and sentence completion section, while the tester shows the child a large cardboard sheet on which are represented possible choices. Each item is scored either 1 or 0 according to the child's correct or incorrect responses. The total numbers of correct responses yield reading or mathematic scores.

The Basic Mathematic Test (BMT)

The BMT has three sections. Section 1 includes items that deal with number concept (10 items) and number symbols (15 items). Section 2 includes measurement such as length, height, width, size (10 items), weight (4 items) and volume (6 items). Section 3 deals with addition and subtraction (10 items), formal operation of plus and minus and the foundations of multiplication and division (12 items).

Ten addition and subtraction test items aim to assess the ability to carry out these operations in partially abstract situations. For example, the tester presents a card with apples on it and says to the child "Here are 2 apples. If I put 2 more here, how many apples would there be altogether?"

The ability to multiply and divide are assessed in a repeated addition and sharing fashion. For example, "if you get £2 per week for feeding the gold fish, how much money would you have by the end of two weeks?" Or, "Here are 6 oranges. If you and your friend share the oranges exactly the same number each, how many oranges would you and your friend have?" and so on (6 items).

Formal operation of plus and minus items require the child to select the right answer and complete the operation. The items are presented visually. The child should be able to understand the operations and the symbols, e.g. 2 + 2 = ?; 6 - 3 = ?; and so on (6 items).

The BMT includes a total of 67 items, thus the maximum mathematics score is 67 and minimum 0. Neither CRT nor BMT are norm-referenced.

Data Collection

The tests were administered on an individual basis twice at a one year interval. The test sessions were brief because many of the children with cerebral palsy have attention deficit disorders as a result of the cerebral injury.

Therefore, the total testing period was broken into many short sessions. The actual testing sessions lasted for 15 minutes maximum and a minimum of 5 minutes. Two to four sessions were required for each child to complete the Reading and Mathematic tests.

Results

Two-way Analysis of Variance was performed to see whether there were any differences in Reading and Mathematics Performance between the Conductive Education and the comparison group.

The results of statistical analysis indicated that there were no significant differences between the two groups in Reading and Mathematics (see TABLE II).

Although there were no differences between the two groups in academic performance, there were significant differences across time for both Reading and Mathematics: both groups performed significantly better in the second year.

Discussion

It was expected that the Manchester children's academic performance would show rates of development superior to that of the Birmingham group. However, the results of the statistical analysis do not support this hypothesis. It was the case that the alternative special education programmes placed more emphasis on the cognitive or academic domains than did Conductive Education which tended to emphasize the physical domain. For example, the Birmingham Institute timetable showed four times more time was devoted to physical development such as walking practice, standing, sitting and fine-motor exercise than in the Manchester schools: while in the Conductive Education Institute only about a half of the time was devoted to academic or cognitive development compared to the comparison programmes (Bairstow *et al.*, 1993).

The comparison children were provided with a wide range of other academic programmes such as science, computer, technology, topic work and so on. They spent an average of 8 hours

TABLE II
Academic performance of children in Conductive Education and children in Comparison Group

Variables	Conductive Education (N = 19)		Comaprison Group (N = 17)		P		
	Time 1 mean	Time 2 mean	Time 1 mean	Time 2 mean	Group	Time	G x T
Reading	32.9	43.4	34.0	42.3	ns	<.001	ns
Mathematics	30.4	35.2	28.4	34.6	ns	<.001	ns

on academic programmes whilst the Conductive Education children spent 4 hours per week. The comparison children followed an individualized programme according to their needs and abilities, while the Conductive Education children followed a group programme.

However, the time allocation for reading and mathematics were similar for both groups: 2 hours per week for each subject.

It appeared that the comparison children were provided with a much more diverse, stimulating and enriched learning environment. The children had opportunities to prepare food in kitchens, use the library, shops and post-offices, drama, dance, handling musical instruments, story telling, swimming and so forth. To facilitate their reading and mathematic skills, the children were often engaged in a structured play involving word and number games. They also had opportunities to visit farms, zoos, theatres and museums.

The methods of teaching reading were also different. The three schools in Manchester used the phonic method in conjunction with 'look and say' or 'life experience' methods. The children in the Conductive Education group were taught reading by mainly phonic method, 'Letter-land'. Thus, differences in academic performance between the two groups were expected, but were not found in this study.

By the same token, the Conductive Education children whose programme specified to spend four times longer on physical exercises than the comparison group, did not achieve higher standards of gross and fine-motor performance. In fact, the Birmingham children showed some deterioriation in the movement of the hips while there was no evidence of such deterioration in the Manchester children.

It would be interesting to follow all those children's development on a long-term basis. Long-term follow up would be particularly valuable, not only for the treatment effect alone but also to prove the claim of Conductive Education. According to the authority (Hari, M. conversation with the authors in October 1989 at the Petö Institute) the long-term effect of Conductive Education is greater than the short-term effect.

Summary

Thirty-six boys and girls with cerebral palsy were studied. Nineteen were enrolled in a Conductive Education Programme in Birmingham and 17 were enrolled in special schools for the physically handicapped in the Greater Manchester area. Their age range was 5 to 6½ years. The two groups were similar in age, IQ, severity of handicapping conditions, conductors' diagnosis, parental social class, and initial levels of independence. The children were assessed twice using specially designed reading and mathematic tests on an individual basis with an interval of one year.

A factorial design with one repeated measure was used to evaluate differences in academic performance between the two groups. The results indicate that there were no significant differences in academic performance between the Conductive Education and comparison group. The result also indicates that there was a significant improvement over time for both reading and mathematics.

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