South African Journal for Research in Sport, Physical Education and Recreation, 2004, 26(1): 79-88.
Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2004, 26(1): 79-88.
ISSN: 0379-9069

A COMPARISON OF THE MOTOR PROFICIENCY OF CHILDREN WITH AND WITHOUT LEARNING DISABILITIES

Glynis K. LONGHURST*, Marius F. COETSEE* & Elizabeth S. BRESSAN**
**Department of Human Movement Science, University of Zululand, KwaDlangezwa, Republic of South Africa*
***Department of Sport Science, Stellenbosch University, Stellenbosch, Republic of South Africa*

ABSTRACT

This study aimed to determine if children with learning disabilities showed any significant differences in motor proficiency from "normal" children, that would warrant special attention when addressing their physical education movement needs. Sixty children with learning disabilities and sixty children without learning disabilities between the ages of 8 to 12 years, were randomly selected and matched by age, gender and home language. The Bruininks-Oseretsky Test of Motor Proficiency was used to assess the motor proficiency of the subjects. An independent t-test indicated that the children without learning disabilities performed significantly better ($p<0.01$) on all eight variables. Effect sizes for the significant comparisons ranged between 0.60 and 2.74, which can be interpreted as moderate to large. In order of magnitude, as expressed by percentage, the children without learning disabilities performed better as follows: balance (147.7%), strength (102.9%), upper limb speed and dexterity (81.4%), visual-motor control (36.4%), bilateral coordination (35.2%), upper limb coordination (34.6%), running speed and agility (33.3%) and response speed (23.8%). A physical education programme for children with learning disabilities should give special attention to activities that would enhance the development of these variables.

Key words: Motor proficiency; Learning disabilities; Physical education.

INTRODUCTION

The impact of learning disabilities on the academic, social and psychomotor performance of children has been a source of concern for parents and educators for several decades (Beyer, 1999). To be able to read, write and perform with adequate success at school, all children need certain abilities. These abilities include motor, sensory motor, auditory motor, visual perceptual, auditory perceptual, language receptive and language expressive abilities (Engelbrecht, 2000). The motor ability of a child is perhaps the most visible of these abilities. Should a child of normal intelligence fail to demonstrate the same academic competencies as do the majority of his/her peers, it is believed that there is a dysfunction in one or more of the above areas. Remedial or special education is recommended when a child has significantly greater difficulties in learning than most children his/her age, or a child has a disability that either prevents or hinders him/her from making use of the educational facilities generally provided in school.

A learning disability is defined as a disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, which may manifest itself in the imperfect ability to listen, think, speak, write, spell or perform mathematical calculations (Auxter *et al*., 1993). Teaching children with learning disabilities will be different in some ways than working with children who learn spontaneously and have all body systems intact and functioning in predictable patterns. In South Africa, children who have been identified and professionally diagnosed with learning disabilities can be placed in remedial schools such as the Zululand Remedial School situated in KwaZulu/Natal, South Africa (South African Association for Learning Disabilities, 2000).

Children with both learning disabilities and dysfunctions in motor ability are at risk for a significant decline in self-esteem. According to Levine (2000), children crave motor gratification as they grow up. Consequently, children are apt to be highly conscious of how they are judged by others. They need to feel that their bodies are somewhat effective in space. Such feelings contribute substantially to the development of a positive body image and self-concept. It is disheartening to have physical/motor inabilities that perpetually bring embarrassment and incite ridicule or criticism. Many studies have shown that the best way to help children achieve a positive self-concept and enhance their learning ability is to train their motor skills, starting in infancy and continuing throughout life (Burton, 1987; Sherrill & Montelione, 1990; Auxter *et al*., 1993; Sherrill, 1993). A lack of physical activity can also have a negative impact on motor development because participation in frequent physical activities is also important for the development of motor skills (Thomas, 1984; Saakslanti *et al*., 1999). Development of motor skills plays an important role in the overall development of school readiness (Pienaar, 1994; Gallahue & Ozmun, 1998).

Although all children with learning disabilities do not display motor problems, many do display such problems (Bruininks & Bruininks, 1977; Sherrill & Pyfer, 1985; Schaffer *et al*., 1989; Miyahara *et al*., 1995). Research done by Haubenstricker (1982) established that children with learning disabilities are weaker than children without learning disabilities on tasks of bilateral co-ordination. Miyahara *et al*. (1995) contended that many children with learning disabilities display visual and spatial motor difficulties and can thus be considered "clumsy". Lazarus (1990) stated that children with learning disabilities showed more overflow movement, had difficult with visual-motor tasks, and were inferior to children without learning disabilities in spatial orientation and tasks requiring motor planning and sequencing of motor acts.

Physical education has a major role to play in the development of children with and without learning disabilities. Physical education should be an integral part of the total education of any child as it is closely allied to other creative expressions and learning experiences, as well as skill acquisitions. One of the fundamental goals of the physical education programme should be to prepare students for the challenges of the 21st century by providing opportunities to attain the skills and knowledge needed to be physically active as part of a healthy lifestyle. Children should become competent in movement forms, motor skills, and social skills and learn to enjoy physical activity while not compromising safety.

Physical education is an important part of the school curriculum. It is not merely "play", "letting off steam" or an activity that is divorced from the other learning experiences in schools. However, to achieve its rightful position as one of the basics, physical education

must be seen in its relationship to the total curriculum. Classroom teachers and physical educators must work together, as both have much to contribute to a goal that cannot be accomplished alone. This working relationship can develop physical education activities that correlate with other learning experiences. The rewards for this effort can be found in the satisfaction of helping children develop their movement and learning abilities to their fullest extent (Hoffman *et al*., 1981). Sherrill (1993) indicates that children with learning disabilities need a different content in physical education than that which exists in most traditional physical education settings.

PURPOSE OF THE STUDY

This study aimed to determine if children with learning disabilities showed any significant differences in motor proficiency from children without learning disabilities, that would warrant special attention when addressing their physical education movement needs.

METHOD AND PROCEDURES

The most accurate method of data collection in a study such as this appears to be direct personal contact between the researcher and the subject (Vincent, 1995). In cognisance of this position, it was decided to confine this study to one local school catering for the special needs of children with learning disabilities, and one local school that did not include children with learning disabilities.

Participants

Sixty children with learning disabilities and 60 children without learning disabilities between the ages of eight to 12 years were randomly selected and matched by age, gender and home language.

Procedure

The researcher approached the principals from the "remedial school" and the so-called ordinary primary school located in Empangeni, KwaZulu/Natal. The research project was fully explained, including the purpose, research protocol and use of results. The Principal and Governing Body Chairman of each school gave written approval of the project to the researcher. Written approval was also received from the Department of Education, the Research Committee of the University of Zululand and the Ethics Committee of the Faculty of Science, University of Zululand. A letter was sent to the parents, which explained the nature and procedures of the study and procured parental and subject approval in an informed consent document.

In this study postgraduate students were used to administer the BOTMP long form. These testers first completed a graduate level Adapted Physical Education training course presented by the researcher who was fully proficient in the BOTMP long form test administration. The testing was done over three days and was conducted in the Remedial School hall. This venue was chosen, as it was free from noise and other distractions and fully complied with the logistical requirements of the BOTMP test.

On arrival at the hall, subjects were seated at pre-placed desks and the hall doors closed. A "Testing - Please Do Not Disturb" sign was placed on the door. During the testing session all children wore their physical education uniforms, consisting of T-shirt, shorts and training shoes. The children where handed a BOTMP individual score sheet. The researcher orally explained the testing procedures to the children. The children were requested to carry the sheet from test station to test station, where the testers at each sub-test station carried out the relevant tests and recorded the children's score on the score sheet. Only one subject and the tester were at a sub station at one time. During the actual testing, each item was demonstrated and where doubt existed, a trial attempt was given to ensure that the children knew what was required of them. A thorough check was made to ensure that the children were free of any condition that could influence the results of the tests and thus invalidate the testing programme. Apparatus used during testing was carefully checked and rechecked before the testing sessions.

Measures

The Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) (Bruininks, 1978) was used to assess the motor proficiency of the subjects. The BOTMP has a long and short form. Verderber and Payne (1987) suggest that the long form provides a more reliable measure of motor deficiencies than the short form, especially for children over 10 years of age. For the purpose of this study the long form was used. Adapted physical education researchers have accepted the face validity of the long form based on the reliability of 0.80 to 0.94 (Sherrill, 1993). Full details for the administration and scoring appears in the Examiner's Manual. The BOTMP consists of eight components which are further divided into 45 sub tests (see Table 1). The BOTMP is widely used in Adapted Physical Education (Parker & Bradshaw, 1987; Miles *et al*., 1988) and is useful in assessing the motor proficiency of children with disabilities (Haubenstricker *et al*., 1981; Stengel, 1991). It is considered to be fun and interesting to children (Roswal *et al*., 1984), and the instructions and trials are useful in gauging the individual's understanding of the motor task to be assessed (Connolly & Michael, 1986). The standardised procedures permit replication and comparison between and within individuals in the study.

TABLE 1. **SUBTEST AND ITEMS FOR THE BOTMP (EXAMINER'S MANUAL, 1978)**

Subtest	Item
STATION 1: Subtest 1: Running Speed and Agility	Running Speed and Agility
STATION 2: Subtest 2: Balance	1. Standing on preferred leg on floor 2. Standing on preferred leg on balance beam 3. Standing on preferred leg on balance beam with eyes closed 4. Walking forward on walking line 5. Walking forward on balance beam 6. Walking forward heel-to-toe on walking line 7. Walking forward heel-to-toe on balance beam 8. Stepping over response speed stick on balance beam

Subtest	Item
STATION 3: Subtest 3: Bilateral coordination	1. Tapping feet alternately with making circles with fingers 2. Foot and finger on same side synchronized 3. Tapping foot and finger on opposite side synchronized 4. Jumping in place - leg and arm on same side synchronized 5. Jumping in place - leg and arm on opposite side synchronized 6. Jumping up and clapping hands 7. Jumping up and touching heels with hands 8. Drawing lines and cross simultaneously
STATION 4: Subtest 4: Strength	1. Standing broad jump 2. Sit-ups 3. Knee or full push-up
STATION 5: Subtest 5: Upper limb coordination	1. Bouncing a ball and catching it with both hands 2. Bouncing a ball and catching it with preferred hand 3. Catching a tossed ball with both hands 4. Catching a tossed ball with preferred hand 5. Throwing a ball at a target with preferred hand 6. Touching a swinging ball with preferred hand 7. Touching nose with index finger - eyes closed 8. Touching thumb to fingertips - eyes closed 9. Pivoting thumb and index finger
STATION 6: Subtest 6: Response Speed	1. Response speed
STATION 7: Subtest 7: Visual-motor control	1. Cutting out a circle with preferred hand 2. Drawing a line through a crooked path with preferred hand 3. Drawing a line through a straight path with preferred hand 4. Drawing a line through a curved path with preferred hand 5. Copying a circle with preferred hand 6. Copying a triangle with preferred hand 7. Copying a horizontal diamond with preferred hand 8. Copying a overlapping pencils with preferred hand
STATION 8: Subtest 8: Upper-limb Speed and Dexterity	1. Placing pennies in a box with preferred hand 2. Placing pennies in two boxes with both hands 3. Sorting shape cards with preferred hand 4 Stringing beads with preferred hand 5. Displacing pegs with preferred hand 6 Drawing vertical lines with preferred hand 7. Making dots in circles with preferred hand 8. Making dots with preferred hand

RESULTS

Means and standard deviations for each of the eight components of the BOTMP are presented in Table 2. Also presented in Table 2 are the t-values for differences between means and the effect size values for each of the statistically significant comparisons.

TABLE 2. **MEANS, STANDARD DEVIATIONS AND T VALUES OF THE BOTMP SUB-TEST ITEMS FOR LEARNING DISABLED AND MAINSTREAM CHILDREN**

Subtest	**Learning disabled (N=60)**	**Mainstream (N=60)**	**Learning disabled vs Mainstream**		
	Mean ± Standard deviation	**Mean ± Standard deviation**	**t- values**	**Omega squared (ω^2)**	**Percentage difference**
Running speed and agility	10.5 ± 6.0	14.0 ± 4.6	* 3.4	0.76	33.3%
Balance	19.7 ± 2.6	48.8 ±10.3	*11.9	2.74	147.7%
Bilateral co-ordination	9.1 ± 5.5	12.3 ± 5.3	* 3.1	0.60	35.2%
Strength	24.2 ± 9.2	49.1 ± 9.4	*15.2	2.64	102.9%
Upper limb co-ordination	10.4 ± 6.5	14.0 ± 4.5	* 3.0	0.80	34.6%
Response speed	13.0 ± 5.6	16.1 ± 4.8	* 3.1	0.64	23.8%
Visual-motor control	11.8 ± 5.7	16.1 ± 3.9	* 4.6	1.10	36.4%
Upper limb speed and dexterity	26.9 ± 8.5	48.8 ± 9.5	*16.8	2.30	81.4%

***** Significance at $p<0.01$

An independent t-test indicated that the mainstream children performed significantly better ($p<0.01$) in all eight variables. Effect sizes for the significant comparisons ranged between 0.60 and 2.74, which can be interpreted as moderate to large. In order of magnitude, as expressed by percentage, the children without learning disabilities performed better as follows: balance (147.7%), strength (102.9%), upper limb speed and dexterity (81.4%), visual-motor control (36.4%), bilateral co-ordination (35.2%), upper limb co-ordination (34.6%), running speed and agility (33.3%) and response speed (23.8%).

DISCUSSION

The purpose of this study was to determine if there were differences in motor proficiency scores of children with learning disabilities and children from mainstream that warranted different approaches for addressing the physical education movement needs. From the results it is clear that there are significant differences in motor abilities between the two groups. A physical education programme for children with learning disabilities should give special attention to activities that would enhance the development of these motor proficiency variables that are most lacking in these children. Therefore activities should be carefully selected and adapted to cater for the special needs of children with learning disabilities. Further research in this regard is recommended.

The results of the study agreed with other findings that children with LD demonstrate poorer motor proficiency than children without LD (Haubenstricker, 1982; Hefley & Gorman, 1986; Korkman & Pesonen, 1994; Miyahara *et al*., 1995; Harvey & Reid, 1997).

The mainstream children performed significantly better than the children with LD on all eight components of the test battery. The poorer performance by children with LD support research findings that performance in fine motor and timed tasks of motor co-ordination are significantly inferior in participants with LD when compared to controls without disabilities (Hefley & Gorman, 1986; Korkman & Pesonen, 1994).

The results also support findings that tasks of bilateral co-ordination, balance and upper limb speed are weaker in children with LD than children without LD (Haubenstricker, 1982; Harvey & Reid, 1997). Miyahara *et al*. (1995) contended that many children with LD display visual and spatial motor difficulties and can thus be considered "Clumsy". Lazarus (1990) stated that children with LD showed more overflow movement, had difficult with visual-motor tasks, and were inferior to children without LD in spatial orientation and tasks requiring motor planning and sequencing of motor acts.

In this study, balance, as measured by the BOTMP, emerged as a characteristic area of weakness for the children with LD. The balancing problems experienced by the children with LD were evident in the low scores obtained by them. Balancing is a complex activity that involves integration of the perceptual and motor systems, an area that children with LD have noted problems with (Burton, 1987). As balance is integral to skilled behaviour (Lazarus, 1990), this level of proficiency is of concern because it impacts further on the classroom performance of the children with LD.

In research studies by Hefley and Gorman (1986) and Kerr and Hughes (1987), children with LD are documented as having deficits in response speed and bilateral co-ordination, but when treated through the means of interventions these deficits improve significantly. Cermak *et al*. (1990) also established that male adolescents with learning disabilities perform poorer than males without learning disabilities on tasks of bilateral co-ordination.

Although significantly poorer on balance, the children with LD showed that on the subtests of running, co-ordination and response speed they could attain stronger levels of proficiency. The lower diffidence in proficiency scores for response speed, co-ordination and running

could be a result of the type of games that the children played, which consisted mainly of running games, kicking and catching of balls.

The lower level of strength showed by the children with LD is consistent with the low muscle tone reported in these children (Connolly & Micheal, 1986; Beyer, 1999).

Researchers have noted that concentration ability and information processing are significantly pooper in some children with LD (Schaffer *et al*., 1989; Harvey & Reid, 1997). This interpretation appears to be supported in the present study. In all of the subtests in which the scores of the children with LD were significantly lower, a high degree of concentration and motor planning was required.

CONCLUSION

It is important to recognise the motor proficiency differences between children with learning disabilities and children without learning disabilities, and to implement special intervention through the medium of physical education programmes in special schools. The importance of developing motor skills of children goes beyond "opening the door" on the multiple benefits derived from participation in physical activity programmes. It is essential if children with learning disabilities are to achieve their potential level of functional autonomy.

ACKNOWLEDGEMENT

The University of Zululand financially supported this research.

REFERENCES

AUXTER, D.; PYFER, J. & HUETTIG, C. (1993). *Principles and methods of adapted physical education and recreation* (7th ed.). St Louis, MO: Mosby.

BEYER, R. (1999). Motor proficiency of boys with Attention Deficit Hyperactivity Disorder and boys with learning disabilities. *Adapted Physical Activity Quarterly,* 4: 403-414.

BRUININKS, R. (1978). *Bruininks-Oseretsky Test of Motor Proficiency - Owner's manual.* Circle Pines, MN: American Guidance Service.

BRUININKS, V.L. & BRUININKS, R.H. (1977). Motor proficiency of learning disabled and non-disabled students. *Perceptual Motor Skills,* 44: 1131-1137.

BURTON, A. (1987). Confronting the interaction between perception and movement in Adapted Physical Education. *Adapted Physical Activity Quarterly,* 4: 257-267.

CERMAK, S.A.; TRIMBLE, H.; CORYELL, J. & DRAKE, C. (1990). Bilateral motor coordination in adolescents with and without learning disabilities. *Physical and Occupational Therapy in Pediatrics,* 10(1): 5-18.

CONNOLLY, B. & MICHEAL, B.T. (1986). Performance of retarded children, with and without Down Syndrome, on the Bruininks Oseretsky Test of Motor Proficiency. *Physical Therapy,* 66: 344-348.

ENGELBRECHT, S. (2000). Personal interview with the headmistress of the Zululand Remedial School, Empangeni, Kwazulu-Natal, 15 May 2000.

GALLAHUE, D.L. & OZMUN, J.C. (1998). *Understanding motor development in infants and children* (4th ed.). Boston, MA: McGraw-Hill.

HARVEY, W.J. & REID, G. (1997). Motor performance of children with attention-deficit hyperactivity disorder: A preliminary investigation. *Adapted Physical Activity Quarterly,* 11(2): 158-169.

HAUBENSTRICKER, J.L. (1982). Motor development in children with learning disabilities. *Journal of Physical Education, Recreation and Dance,* 53: 41-43.

HAUBENSTRICKER, J.; SEEFELDT, V.; FOUNTAIN, C. & SAPP, M. (1981). *The efficiency of the Bruininks Oseretsky Test of Motor Proficiency in discriminating between normal children and those with gross motor dysfunction.* Boston, MA: Little Brown.

HEFLEY, R.D. & GORMAN, D.R. (1986). Psychomotor performance of medicated and non-medicated hyperactivity emotionally handicapped children and normal children. *American Corrective Therapy Journal,* 40(4): 85-90.

HOFFMAN, H.A.; YOUNG, J. & KLESIUS, S.E. (1981). *Meaningful movement for children: A developmental theme approach to physical education.* Boston, MA: Allyn and Bacon.

KERR, R. & HUGHES, K. (1987). Movement difficulty and learning disabled children. *Adapted Physical Activity Quarterly,* 4: 72-79.

KORKMAN, M. & PESONEN, A.E. (1994). A comparison of neuropsychological test profiles of children with an attention deficit hyperactivity disorder and/or learning disorder. *Journal of Learning Disabilities,* 27: 383-392.

LAZARUS, J.C. (1990). Factors underlying inefficient movement in learning-disabled children. In G. Reid (Ed.), *Problems in motor control: Advances in psychology* (241-288). Amsterdam: North-Holland.

LEVINE, M. (2000). Childhood neuro-developmental dysfunction and Learning disorders. *Journal of Child Neurology,* 10: 2-5.

MILES, B.H.; NIERENGARTEN, M.E. & NEARING, R.J. (1988). A review of the eleven most often-cited assessment instruments used in physical education. *Clinical Kinesiology,* 42(2): 33-42.

MIYAHARA, M.; MOBS, I. & DOLL-TEPPER, G. (1995). Subtypes of clinically identified children with hyperkinetic syndrome based upon perceptual motor function and classroom behaviors. In I. Morisbak & P.E. Jorgensen (Eds.), *The 10th International Symposium on Adapted Physical Activity: Quality of life through adapted physical activity, a lifespan concept* (278-286). Oslo: Ham Tryk.

PARKER, J.L. & BRADSHAW, A. (1987). The Bruininks Osestesky test of Motor Proficiency. *Australian Council for Educational Research Newsletter,* 42: 21-23.

PIENAAR, A.E. (1994). Die voorkoms en remediëring van grootmotoriese agterstande by 6-9 jarige kinders in die junior primêre fase. Unpublished doctoral dissertation. Potchefstroom: PU for CHE.

ROSWAL, G.; FRITH, G. & DUNLEAY, A.C. (1984). The effects of a developmental play program on the self-concept, risk taking behaviors and motoric proficiency of mildly handicapped children. *Physical Education,* 41(1): 43-50.

SAAKSLANTI, A.; NUMMINEN, P.; NINIKOSKI, A.; RASK-NISSILA, R.; VIKARI, J.; TUMINEN, J. & VALIMAKI, I. (1999). Is physical activity related to body size, fundamental motor skills, and CHD risk factors in early childhood? *Pediatric Exercise Science,* 11: 327-340.

SHERRILL, C. (1993). *Adapted physical education, recreation and sport: Cross disciplinary and lifespan approah* (4th ed). Dubuque, IA: Wm.C.Brown.

SCHAFFER, R.; LAW, M.; PALATAJKO, H. & MILLER, J. (1989). A study of children with learning disabilities and sensorimotor problems or let's not throw the baby out with the bath water. *Physical and Occupational Therapy,* 9(3): 101-117.

SHERRILL, C. & PYFER, J. (1985). Learning disabled students in physical education. *Adapted Physical Activity Quarterly,* 2(4): 283-291.

SHERRILL, C. & MONTELIONE, T. (1990). Prioritizing Adapted Physical Education: A pilot study. *Adapted Physical Activity Quarterly,* 7(4): 355-369.

SOUTH AFRICAN ASSOCIATION FOR LEARNING DISABILITIES (2000). *Fact sheet no 1*. Cape Town: Struik.

STENGEL, T.L. (1991). Assessing motor development in children. In S.K. Campbell (Ed.), *Pediatric neurologic physical therapy* (2nd ed.) (33-65). Melbourne: Churchill Livingstone.

THOMAS, J.R. (1984). *Motor development during childhood and adolescence*. Minneapolis, MN: Burgess.

VERDERBER, J. & PAYNE, V.G. (1987). A comparison of the long and short forms of the Bruininks Oseretsky Test of Motor Proficiency. *Adapted Physical Activity Quarterly*, 4(1): 51-59.

VINCENT, W.J. (1995). *Statistics in Kinesiology.* Champaign, IL: Human Kinetics.

Dr. Glynis K Longhurst: Department of Human Movement Science, University of Zululand, Private Bag X1001, Int. Box 148, KwaDlangezwa 3886, Republic of South Africa. Tel: +27 (0)35 902-6395, Fax: +27 (0)35 092-6386, E-mail: gkscheep@pan.uzulu.ac.za

(Subject editor: Prof. P.E. Krüger)