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ABSTRACT

This study examined the effectiveness of a 9-month highly structured program of psychomotor development with 174 severely handicapped students ranging in age from 2 to 20 years. Curriculum based measures (CBM) of exemplar performance objectives were developed. Teaching was individualized by a teaching research model of instruction in both public school and higher education settings. Inservice and preservice personnel with no previous expertise in adapted physical education or psychomotor learning served as teachers after training using a metacognitive approach. Results indicated that severely handicapped learners, whether ambulatory or wheel chair users, can, with this type of training, significantly increase psychomotor performance. (Includes 23 references.) (DB)

Using Curriculum Based Measurement to Increase Psychomotor Learning Gains in Severely Handicapped Students

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Running Head: Curriculum Based Measurement

Abstract

The increase in psychomotor learning gains by severely handicapped using curriculum based measures of exemplary performances was investigated. 174 severely handicapped students ranging in age from 2 to 20 participated as subjects in a nine month highly structured program of psychomotor development. Teaching was individualized by a teaching research model of instruction in both public school and higher education settings. Inservice and preservice personnel with no previous expertise in adapted physical education or psychomotor learning served as teachers after training by metacognition. Data indicated that severely handicapped learners could significantly increase psychomotor performances whether ambulatory or wheel chair users. Results further substantiated the need for early intervention in the psychomotor domain for the severely handicapped.

Curriculum Based Measurement to Increase Psychomotor Learning Gains in Severely Handicapped Students

The diversity and variance of learning rates for handicapped learners in cognitive and affective performances has received considerable empirical inquiry since the passage of Public Law 94-142. The rate of learning in psychomotor performances by severely handicapped learners, however, has received very little systematic inquiry. Such has been the result of: (1) a significant lack of appropriate psychomotor performance bases by which to measure learner growth; (2) an activity versus motor behavior paradigm of teaching; and (3) the complex and interactive deficiencies of severely handicapped learners with respect to physical ability, cognitive capacity and affective interference.

Human movement is controlled through a biological amalgam of voluntary, stereotypic, and reflex actions. Evidence suggested that children use information in a systematic way to arrive at causal attributions for success and failure (Weiner, 1979, 1985). Similarily, performance increases on a psychomotor coordination task were found when mentally handicapped individuals were told to attribute success to ability and failure to a lack of effort (Zoeller, Mahoney, & Weiner, 1983). Ulrich et al. (1989) noted that motor development specialists working with the mentally retarded frequently employ visual observation as their principal assessment strategy while implementing individualized instruction.

Integration of the severely handicapped was a highly visible topic in the literature with researchers continually attempting to isolate

determinants of success or failure (Kreger, Wehman, Seyfarth, & Marshall, 1986). Based on the status of special education to date, it was apparent that successful integration of the severely handicapped into least restrictive environments relied significantly on their ability to learn functional and age-appropriate psychomotoric behaviors.

It had been found that children being handicapped or non-handicapped was not significantly related to motor performance (Karper & Martinek, 1983). It may very well be that the severely handicapped demonstrated ineffective and inefficient psychomotor performance because of a lack of systematic teaching experiences. Nevill (1988) noted that by plotting a group's perceived mean trial profile for any significant trial-by-factor interaction, valuable insight could be gained into different performance responses in trial adaptation.

The results of such findings without severely handicapped populations restricted generalizations about the potential parameters for psychomotor ability and learning rates of the severely handicapped. Very few motor behavior researchers have attempted to identify basic synergistic patterns of control and performance in the severely handicapped. As a result there was a lack of knowledge that would entertain a basic hypothesis. Winter (1987) suggested a response to this hypothetical dilemma by: (1) perturbing certain obvious motor performance variables and observe resultant changes; and/or, (2) observing the particular and relate it to the general.

The implications for psychomotor learning in the severely handicapped learner relative to movement function, attributional

success, and instructional observation was significantly limited in part to categorical labeling ambiguity and instability as suggested by Wolman, Thurlow and Bruininks (1989). As early as 1976, Lewko reported that many professionals were responsible for determining the psychomotoric characteristics of learners with special needs. However, classification of the severely handicapped learner remained nebulus in that Public Laws 94-142 and 99-457 did not specify severely handicapped as an eligible handicapping condition. Subsequently, severely handicapped learners have been designated within existing categorically assigned and recognized handicapping conditions of legislation, placed in a multitude of educational environments in public schools, and taught by various types of professionals and paraprofessionals.

Design Perspectives

Information about the psychomotor learning ability of the severely handicapped learner was divergent in that it frequently lacked uniformity within instructional delivery systems employed according to generalized and specific performances. In addition to the disregard of observational skill level by professionals (Ulrich et al., 1989), minimal attention had been devoted to estimating and interpreting the conceptual framework and measurement procedures for determining the psychomotor performance of the severely handicapped.

From that perspective, psychomotor performances of the severely handicapped needed to be established in a design of motoric typicality. The challenge therefore was to define motoric typicality. The selected

approach was to characterize the psychomotoric behavior of age-appropriate and mature performances of requisite: (1) body mechanics; (2) body knowledge; (3) locomotion; (4) spatial accuracy; (5) health and fitness; and (6) sensorimotor control goal areas of exemplary performance in a relevant environment as adapted from Bem and Funder (1978). Presumably, such performance based objectives needed to be premised upon non-categorical elements within the population of the severely handicapped with few constraints upon psychomotoric proficiency. This perturbance of obvious motor performance variables (Winer, 1987) resulted in the development of psychomotor curriculum based measures for the severely handicapped (CBM) (Powers et al. 1986; 1985) for preschool, elementary, and secondary exemplary performances. Bem and associates (Bem, 1982; Bem & Funder, 1978; Bem & Lord, 1979) referred to such descriptions of exemplary performance as templates.

This study used the template paradigm to develop an assessment scale for the severely handicapped that established content validity for psychomotor proficiency levels in the severely handicapped (Powers, 1987) relative to an exemplary performance objective scoring index (POSI) according to the following performance levels: (1) non-functional; (2) pre-functional; (3) functional; (4) age-appropriate; (5) proficient age-appropriate; and (6) advanced proficient age-appropriate. Evidence about the psychomotor learning rates of the severely handicapped were based on the degree of match between the learner's CBM entry motor behavior and the POSI template.

There existed no uniform classification system for the psychomotor performances of the severely handicapped learner. However, Silverstein, Lozano, and White (1989) stated that classification was a basic human conceptual activity and cluster analysis a generic term for a wide variety of multivariate statistical procedures that could be used to create a classification by forming groups of similar individuals. In response to the absence of a psychomotor classification of the severely handicapped learner, enhanced classification conceptualization was obtained by establishing an interactive relationship between the exemplary performance standards of the CBM and the POSI template.

Even though the classification of the psychomotor performance for the severely handicapped had been generated, the use of systematic measurement and data evaluation procedures still required resolution. It was obvious that ongoing measurement and evaluation procedures had a positive effect upon student achievement as reported by Fuchs and Fuchs (1986) whereby such procedures increased average achievement by .7 of a standard deviation. Support for this hypothesis of increased and systematic practice was also derived from the observational research on active learning time (Leinhardt, Zigmond, & Cooley, 1981). Coupled with Gickling, Hargis, and Alexander's (1981) findings that increased memory performances must include overlearning, repetition, and use of visual memory, a systematic teaching model for the study was indicated.

The development of a teaching research model of instruction (TRMI) to accomplish ongoing measurement and evaluation procedures based upon

CBM exemplary performances and POSI templates was subsequently formulated. The first premise used in the sequence reaction time. Sequential reaction time research in motor control suggested a possible predominance of advance planning when the same sequence was repeated over a series of trials (Garcia-Colera & Semjen, 1988). The second premise was response amplitude. Analysis of response amplitude suggested that when visual and kinesthetic stimuli were combined, both stimuli triggered a response. Thus indicated was greater consistency to a simple behavioral model with the addition of visual and kinesthetic responses rather than a model of exclusion of one response (Flanders & Cordo, 1986).

As a result, the TRMI developed was a systematic and sequentially three phased process of: (1) teacher cue of exemplary CBM performance; (2) teacher modeling of advanced proficient age-appropriate template; and (3) three teacher physical assists of CBM performance at advanced proficient age-appropriate template.

Individualized and contingent technical feedback and/or positive reinforcement was designed to be provided to each severely handicapped learner at a ratio of 7:1 per entire learning trial of the TRMI. Learner feedback was of central importance for the development of motor control with the acquisition rate directly related to the amount of feedback made available to the learner (Schmidt, 1982). The TRMI consisted of multiple physical assists with forced proprioceptive, visual, verbal, and tactile feedback to the learner. Mulder and Hulstijn (1985) demonstrated that artificial (i.e. forced) feedback of proprioceptive,

visual, and tactile feedback was more powerful than natural feedback. The forced verbal feedback during physical assists of the TRMI was added to permit the learner contingent technical feedback in an associate manner with CBM exemplary performances relative to POSI templates.

Phase One: Teacher Cue of CBM Exemplary Performance

The ability to remember a related skill was determined to be essential to the learning process. Short term memory deficits in retarded individuals had been identified (Ellis, 1970) and ~~it has been~~ established that retarded individuals did more poorly than non-handicapped learners on tasks that required remembering previously learned materials (Borowski, Peck, & Damberg, 1983). In selecting movement sequences, the number of sequence items needed to be limited, or varied within, a rather narrow range with sequences executed under speed of instruction (Rosenbaum, Inhoff, & Gordon, 1984). To address these concerns individualized cueing of exemplary CBM performance was critical during all phases of the TRMI (e.g. "Angie, transfer to the wheelchair") consistent to the respective POSI template. All cueing and re-cueing was constant throughout all phases of the TRMI with incorrect performances responded to by overt and neutral contingent technical instruction (e.g. "No Angie, that is not a transfer to the wheelchair"). Consistent cueing served to enhance short term memory while neutral contingent technical instruction alleviated discrepany in choosing movement sequences.

Phase Two: Teacher Modeling of Advanced Proficient Age-appropriate Template

Visual guidance in facilitating the translation of cognitive representations into action consisted of severely handicapped learners matching a modeled psychomotor performance pattern with the CBM exemplary performance after a CBM model by a teacher. Carroll and Bandura (1988) found that the more accurate a cognitive representation, the more skilled were subsequent reproductions of the modeled actions. These results were in accordance with the theory that cognitive representation mediated response production and corrective adjustments through visual guidance to aid in the translation of conception into action. Modeling in the TRMI allowed a cognitive representation of CBM exemplary performance response production while providing a standard against which POSI template performance feedback could be compared.

Phase Three: Three Teacher Physical Assists Multiple Physical of CBM Performance at Advanced Proficient Age-appropriate Template

Ocular motor and external manual motor control systems had parallels which could be attributed to response planning. Continuous oculomotor and limb responses were much improved if control systems are moved in predictable actions so that the performance is specified (Mather & Putchat, 1983). TRMI multiple physical assists avoided inhibitation to attaining higher units of performance by taking into account: (1) integration of working memory; (2) cognitive limitations

of the severely handicapped learner; and, (3) translating what is observed into action by effectors as was suggested by Welford (1988).

CBM's ongoing measurement and evaluation purpose was not to increase active learning time, but to generate precise quantifiable data for evaluating instructional effectiveness (Wesson et al., 1988). The TRMI was a formative process considerate of CBM exemplary performances and POSI templates to produce higher psychomotor achievement outcomes for the severely handicapped learner.

Method ← Triple Space

To accomplish this, special education inservice and preservice personnel with no experience in psychomotor learning were trained to use the TRMI for severely handicapped learners who were either ambulatory or wheelchair users. The procedures were developed by special education faculty (Powers et al., 1987a) and sponsored by funding from the U.S. Education Department, Office of Special Education and Rehabilitative Services. Fuchs et al.'s (1984) examination of the effectiveness of teachers using formative evaluation procedures and structure provided an orientation to the study even though that study did not include the severely handicapped. Thus, the primary hypothesis of this study was whether a TRMI interactively linked to CBM exemplary performances and POSI templates resulted in increases of psychomotor learning gains by severely handicapped students.

Subjects and Setting

The research was conducted in a higher education based teaching academy, two suburban school districts, one remote school district, a

USED/OSERS demonstration handicapped preschool and, one rural special education cooperative. A sample of 174 severely handicapped learners as classified by their IEP's and receiving special education in self-contained classrooms participated as subjects. Subjects ranged in age from 2 to 20. A total of 94 males and 80 females (54 and 46% respectively) were exposed to TRMI. Subjects median age was 15 years. Chronological age was divided into non-categorical divisions to assign subjects to CBM psychomotor databases. CBM breakdown was as follows: Preschool, CA = 0-6; elementary, CA = 7-14; and secondary, CA = 15-22. Forty-four percent of subjects were classified as severely handicapped by their school district; 35% as profoundly handicapped; 15% as moderately handicapped; and, 6% were not specifically classified by their school district. Seventy-three percent of the subjects were ambulatory, 20% were wheelchair users, and 7% were partially ambulatory. The subjects did not receive adapted physical education services according to an IEP other than that received by participation in the study.

In sum, 174 subjects were provided TRMI by two groups of teachers. A total of 96 (55.2%) of subjects were taught by inservice special education classroom teachers or graduate students and 78 (44.8%) were taught by preservice undergraduate students. None of the participating preservice or inservice teachers had any prior experience and/or training in adapted physical education or psychomotor learning. The number of hours per week each subject received TRMI was dependent upon

variables of: (1) school schedule; (2) geographic remoteness of school district; and (3) availability of TRMI trained personnel.

TRMI was delivered to the subjects in three settings. Forty-eight percent of TRMI was provided in a campus based teaching academy in special physical education; 45% in rural local education agencies; and 7% in a USED/OSERS demonstration handicapped pre-school.

Procedures

All participating 61 preservice and inservice teachers were trained to carry out specific TRMI procedures for CBM exemplary performance objectives within the six TRMI psychomotor databases developed specifically for the severely handicapped. A metacognition process of training was used during an eight hour training session conducted over two days.

All training workshops were conducted by USED/OSERS project staff employing video-tape, media, materials, and professional resources developed by the Project (Powers, 1987a). Training participants demonstrated mastery of CBM exemplary performance objectives, POSI scoring templates, and TRMI psychomotor databases by written examination. A score of 90% or better was considered to demonstrate competency and teachers were required to achieve knowledge base competency prior to teaching any subjects. Additionally, all teachers were required to demonstrate 90% competency with two project staff inter-rater reliability measures of competence in the TRMI process as determined by a standardized procedure that evaluated: (1) cueing; (2) modeling; (3) physical assistance; and (4) positive reinforcement.

Teachers then developed and implemented psychomotor IEP's for subjects using the POSI templates for entry level pre-assessment values (Powers & Edeburn, 1987) according to CBM exemplary performance objectives in the six CBM goal areas. TRMI was then conducted for nine months with a mean of 4.12 hours per week per subject. Post-test POSI template values were calculated at the end of the academic year to determine the mean psychomotor learning gains of the subjects.

During the academic year, TRMI competence of teachers was assessed weekly by: (1) project staff onsite observations; (2) video-taping of instructional sessions for all teaching academy subjects and teachers; as well as (3) weekly two hour long Project staffings. Also, each teacher had to re-establish CBM knowledge and TRMI competence by written examination and inter-rater reliability measures in both January and March.

Measures

The measures were designed to collect data on 283 psychomotor variables of CBM exemplary performances in the goal areas of: (1) body mechanics; (2) body knowledge; (3) locomotion; (4) spatial accuracy; (5) health and fitness; and (6) sensorimotor control. Each subject was exposed to TRMI up to a maximum of 10 CBM exemplary performances distributed among the six CBM goal areas for nine months based on pre-assessment scores using the POSI templates. The differences between pre-assessment and post-test performances were measured by the POSI standardized values (Powers & Edeburn, 1987)to determine mean psychomotor learning gains in each subject.

The POSI template represented a standardized scoring scale between 0-60 based on each of the 283 variables of the CBM exemplary performances. Mean psychomotor performance gains were then compared to the number of times the subjects were taught an individual CBM exemplary performance objective (CBMEPO) to determine value and probability of for each respective CBEMPO and TRMI psychomotor database. For statistical purposes, alpha values were established at <.05 whereas for classroom settings, alpha values were <.10. CBMEPO from the elementary (42.2%) and secondary (24.1%) TRMI psychomotor database collections comprised nearly two-thirds (64.3%) of 174 applications to the 283 variables.

Results

Results indicated both statistically and for classroom settings that psychomotor learning gains and rates were significant in severely handicapped learners, particularly at the elementary level (i.e. CA 7-14). No results were reported for secondary aged wheelchair user subjects (i.e. CA 15-22) as none participated in the study. In detailed analysis of the data there were discrepancies between the mean rate of learning gains and the magnitude of value and probability levels. Results, however, indicated an educationally sound argument for more learning trials as well as more severely handicapped learners to be distributed among the 283 variables of CBMEPO's. The results further indicated that psychomotor learning in an academic year can increase significantly by the severely handicapped but they are likely to regress if not exposed to systematic and continual instruction.

Preschool Ambulatory Data

As can be seen, significant gains ($p<.05$) were present in 13 of the 18 comparisons. In the case of CBMEPO's, slide, overhand throw, and ascending/descending stairs, only one subject was involved and hence statistical comparisons were not implemented. It should be noted that positive growth (3.00, 8.00, and 3.00 respectively) was present in all three cases. For some reason, regression rather than growth was in CBMEPO's vertical jump and body parts. Subjects actually achieved lower scores at the time of the post-test. The losses noted, however, were not significant as evidenced in the P levels of .3595 and .5957 respectively.

Insert Table 1 about here — Triple space

Elementary Ambulatory Data

A total of 19 CBMEPO's were measured and 17 of the 19 (87%) revealed significant gains in psychomotor performance. Although positive gains were observed in the two-handed sidearm strike (1.50 mean gain), the difference was not significant (P =.1817). Also for some unknown reason walking performance scores regressed (-.86) but the decrease in achievement was not significant (P =.1648).

Insert Table 2 about here — Triple space

Secondary Ambulatory Data

As was noted, significant differences ($P<.05$) were measured in 11 of the 14 CBMEPO's attempted. Two of the CBMEPO's were attempted with only one subject (see underhand throw and dynamic balance) and although

both gains (2.00 and 4.00 respectively) were positive there was no basis for statistical comparisons. One attempt on CBMEPO move to an even beat, did not register a significant gain (P =.1747).

Insert Table 3 about here — Triple SPACE

Preschool Wheelchair User Data

A total of 16 CBMEPO's were measured and seven (44%) revealed a significant gain (P<.05). Two CBMEPO s, posture adjustment in a wheelchair, and holding/carrying objects, were initiated with only one subject and although gain was positive (3.00 and 5.00 respectively), no statistical comparison could be performed. The remaining seven CBMEPO's revealed positive but non-significant gains with P levels ranging from .1639 to .1817.

Insert Table 4 about here — Triple Space

Only eight subjects participated in the TRMI psychomotor elementary wheelchair user database. Even though positive gains were evidenced for two of the CBMEPO's, throwing an object and striking an object, the overall results were probably misleading and therefore not presented. Also, no subjects participated in the TRMI psychomotor secondary wheelchair user database and no results were reported.

Composite psychomotor gain data

Results indicated that significant composite psychomotor learning gains were achieved (x =2.16) in 40% of the total available CBMEPO inventory within the TRMI psychomotor databases. These dat clearly indicated that severely handicapped learners were indeed capable of both educationally and statistically significant increases in psychomotor

proficiency if provided systematic and individualized instruction according to CBM exemplary performance standards.

Insert Table 5 about here — Triple Space

Data was highly evidenced for the TRMI psychomotor elementary ambulatory database where the study had 70 subjects. Results of collected data and treatment procedures did in fact regard the obvious discrepancies between the size differential of median psychomotor gains as well as the magnitude of t and P. This was due to the variable number of subjects attempting the CBMEPO's. For example, CBMEPO, posture maintained during transfer, in preschool wheelchair user database (Gain =.86, t =2.28, P =.0401) was likely due to a larger number of subjects. In the case of CBMEPO, pushing objects while in a wheelchair, (Gain =2.50, t =1.73, P =.1817) there was an insufficient number of subjects to establish mathematical variance. This gain probably would possess greater significance if more subjects in followup studies were exposed to TRMI treatment on this CBMEPO. Data indicated a need for greater longitudinal exposure by subjects to all TRMI psychomotor databases as well as an even larger population of subjects.

Discussion

This study found that severely handicapped learners were in fact extremely capable of significant learning achievement in both phylogenic and ontogenic motor behaviors if provided systematic instruction in accordance to CBM exemplary psychomotor performance standards. It must be noted, however, that such was only likely to occur under highly structured instruction in an individualized learning environment.

The results also suggested a need to additionally investigate the relationship between the learning of motor behavior and its integration into play, game, sport, and leisure activities after the severely handicapped acquire requisite psychomotor behaviors and age-appropriate motor control. This relationship was not established due to the fact that the methodology of the study was exclusively characterized by individualized, one-to-one TRMI instruction and did not attempt to measure psychomotor performance in reciprocal or other interactive learning environments typically found in physical education or youth sport programs.

An extremely promising finding was that results significantly supported the need for early intervention in the area of psychomotor development and behavior for preschool aged (CA = 0-6) severely handicapped learners. Results were convincing in establishing the requirement for structured psychomotor programs for severely handicapped toddlers and preschoolers. Data were noteworthy in reinforcement of the mandate for the provision of psychomotor programs for preschool aged

severely handicapped learners by Public Law 99-457. Such was critical if educational systems expect the severely handicapped to matriculate into developmentally age-appropriate educational programs as currently exist in public schools. Further, it came as no real surprise that the severely handicapped preschoolers would exhibit significant achievement gains given the plethora of research already available substantiating the benefits of early intervention in cognitive and affective performance areas. It was additionally encouraging to find that equivalent results can be expected in the psychomotor domain.

Perhaps the most significant finding of the study was the fact that achievement of significant psychomotoric learning gains by severely handicapped learners did not require highly trained professionals. Of the 61 preservice and inservice personnel who participated as teachers in the study, none had any prior specialized professional training in adapted physical education and psychomotor development, learning, or behavior. These results indicated that no longer does access to quality physical education programs by the severely handicapped have to be an expensive proposition to public schools because of a perceived need to employ specialized and trained professionals to provide appropriate psychomotor experiences for this population. Regardless, the results of this study and dispelled current prejudical perspectives that severely handicapped learners are incapable of learning prerequisite play, game, sport, and leisure psychomotor skills to facilitate a productive and socially interactive lifestyle. More importantly, this study substantiated the need for highly structured and academically oriented

physical education services for the severely handicapped as was their civil right under Public Laws 94-142 and 99-457. What should no longer be at issue is the debate as to whether or not the severely handicapped will be afforded the opportunity for quality physical education experiences. Rather, the issue to be addressed should be as to what interested teacher and/or paraprofessional is committed toward helping the severely handicapped learner maximize individual potential through a structured and systematic academic orientation in psychomotor development and learning.

REFERENCES

Bem. D.J. (1982). Assessing situations by assessing persons. In D. Magnusson (Ed.). Toward a Psychology of Situations: An Interactional Perspective. Hillsdale, N.J.: Erlbaum.

Bem. D.J., & Funder. D.C., (1978). Predicting more of the people more of the time: assessing the personality of situations. Psychological Review. 85. 485-501.

Bem. D.J., & Lord. C.G. (1979). Template matching: a proposal for probing the ecological validity of Experimental settings in social psychology. Journal of Personality and Social Psychology. 37. 833-846.

Borowski. J., Peck. V., & Damberg, P. (1983). Attention. memory and cognition. In J.L. Matson & J.A. Mulich (Eds.). Handbook of Mental Retardation (pp. 479-497). New York: Pergamon Press.

Carroll. W.R., & Bandura, A. (1987). Translating cognition into action: the role of visual guidance in observational learning. Journal of Motor Behavior. 19. 385-398.

Ellis. N.R. (1970). Memory processes in retardates and normals. In N.R. Ellis (Ed.). International Review of Research in Mental Retardation (Vol. 4). New York: Academic Press.

Flanders. M., Cordo, P.J., & Anson, J.G. (1986). Interaction between visually and kinesthetically triggered voluntary responses. Journal of Motor Behavior. 18. 427-488.

Fuchs. L.S., Deno, S.L., & Mirkin, P.K. (1984). The effects of frequent curriculum based measurement and evaluation on pedagogy. student achievement, and student awareness of learning. American Education Research Journal. 21. 449-460.

Fuchs. L.S. & Fuchs. D. (1986). Effects of systematic formative evaluation: A meta-analysis. Exceptional Children. 53. 199-208.

Garcia-Colera. A. & Semjen. A. (1988). Distributed planning of movement sequences. Journal of Motor Behavior. 3. 341-367.

Gickling. E., Hargis. C. & Alexander. D. (1981) The function of imagery in sight word recognition among retarded and non-retarded Children. Education and Training of the Mentally Retarded. 16. 259-263.

Karper. W.B., & Martinek. T.J. (1983). The differential influence of instructional factors on motor performance among handicapped and non-

handicapped children in mainstreamed physical education classes. Educational Research Quarterly, 8, 41-46.

Kreger, J., Wehman, P., Seyfarth, J., & Marshall, K. (1986). Community integration of young adults with mental retardation: transition from school to adulthood. Education and Training of the Mentally Retarded, 21 (1), 35-42.

Leinhardt, G., Zigmond, N., & Cooley, W. (1981). Reading instruction and its effects. American Education Research Fournal, 18, 343-361.

Lewko, J.H. (1976). Current practices in evaluating motor behavior of disabled children. The American Journal of Occupational Therapy, 30, 113-119.

Marteniuk, R., & Chatt, C. (1983). Parallel ocular and manual tracking of a continuous visual target. Journal of Motor Behavior, 15, 29-38.

Mulder, T., & Hulstijn, W. (1985). Sensory feedback in the learning of a novel motor task. Journal of Motor Behavior, 17, 110-128.

Nevill, A.M. (1988). The analysis of errors in short term motor memory research using trial profiles. Journal of Motor Behavior, 20, 165-179.

Powers, P.J., (1987a). Implementation Guide for the RISPE Based Psychomotor Program for the Severely Handicapped Preschool Through Secondary. Missoula, MT: University of Montana.

Bold

Powers, P.J. (1987b). RISPE Assessment Scale for the Severely Handicapped. Missoula, MT: University of Montana.

Powers, P.J. & Edeburn, C. (1987). RISPE Psychomotor Program Computerized Data Collection Process for the Severely Handicapped. Missoula, MT: University of Montana.

Powers, P.J., et al. (1985). A Data Based Psychomotor Program for Profoundly/Severely Handicapped Aged Children. Missoula, MT: University of Montana.

Powers, P.J. et al. (1986). A Data Based Psychomotor Program for Wheelchair User Profoundly/Severely Handicapped Aged Children. Missoula, MT: University of Montana.

Rosenbaum, D.A., Inhoff, A.W., & Gordon, A.M. (1984). Choosing between movement sequences: A hierarchial editor model. Journal of Experimental Psychology: General, 113, 372-393.

Schmidt, R.A. (1982). Motor Control and Learning: A Behavioral Emphasis. Champaign, IL: Human Kinetics.

Silverstein, A.B., Lozana, G.D., & White, J.F. (1989). A cluster analysis of institutionalized mentally retarded individuals. American Journal on Mental Retardation, 94, 1-5.

Winter, D. (1987). Are hypothesis really necessary in motor control research? Journal of Motor Behavior, 19, 276-279.

Ulrich, D., Riggen, K., Ozmun, J., Screws, D., & Cleland, F. (1989). Assessing movement control in children with mental retardation: a generalizing analysis of observers. American Journal on Mental Retardation, 94, 170-176.

Weiner, B. (1979). A theory of motivation for some classroom experiences. Journal of Educational Psychology, 71, 3-25.

Weiner, B. (1985). An attibutional analysis of achievement motivation. Journal of Personality and Social Psychology, 15, 1-20.

Welford, A.T. (1988). Acquiring skill: some experiences. Journal of Motor Behavior, 20, 458-461

Wesson, C., Deno, S., Mirkin, P., Maruyama, G., Skiba, R., King, R., & Sevick, B. (1988). A causal analysis of the relationships among ongoing curriculum based measurement and evaluation, the structure of instruction, and student achievement. Journal of Special Education, 22, 330-343.

Wolman, C., Thurlow, M., & Bruininks, R. (1989). Stability of categorical designations for special education students: a longitudinal study. The Journal of Special Education, 23, 213-222.

Zoeller, C., Mahoney, G., & Weiner, B. (1983). Effects of attribution training on the assembly task performance of mentally retarded adults. American Journal of Mental Deficiency, 88, 109-112.

TABLE 1

MEAN GAIN, t VALUE AND PROBABILITY OF t FOR TRMI PSYCHOMOTOR PRESCHOOL AMBULATORY DATABASE

CBMEPO	Mean Gain	t	p
Run	3.33	5.51	.0001
Slide	3.00*	--	--
Vertical Jump	-4.57**	-.95	.3595
Underhand Roll	2.18	7.13	.0001
Overhand Throw	8.00*	--	--
Kick	5.25	3.98	.0053
Catch	6.00	4.94	.0003
Body Parts	-1.09**	-.54	.5957
Log Roll	2.70	13.08	.0001
State 2 pt. Balance	1.50	4.45	.0010
Trunk/Leg Flexibility	3.18	5.88	.0001
Relaxation	4.30	3.70	.0015
Abdominal Strength	7.67	2.10	.0506
Sitting	2.25	2.87	.0106
Standing	2.42	4.21	.0003
Walking	3.67	8.70	.0003
Ascending/Descending Stairs	3.00*	--	--
Holding/Carrying Objects	4.00	6.93	.0062

* Activity limited to one subject. No basis for statistic comparison.

** Subject regressed during TRMI.

TABLE 2

MEAN GAIN, t VALUE AND PROBABILITY OF t FOR TRMI PSYCHOMOTOR ELEMENTARY AMBULATORY DATABASE.

CBMEPO	Mean Gain	t	p
Run	2.54	6.80	.0001
Horizontal Jump	2.47	7.80	.0001
Underhand Throw	1.73	2.51	.0178
Overhand Throw	1.25	2.55	.0383
Kick	2.41	6.46	.0001
Catch	5.00	11.40	.0001
Backhand Strike	4.00	6.93	.0062
2-Handed Sidearm Strike	1.50	1.73	.1817
Body Actions	2.00	5.90	.0001
Forward Roll	2.00	2.18	.0575
Static 2 pt. Balance	1.44	3.79	.0015
Static 1 pt. Balance	2.25	7.03	.0001
Dynamic Balance	1.91	3.50	.0020
Trunk/Leg Flexibility	3.00	7.37	.0001
Abdominal Strength	2.41	3.75	.0011
Walking	-.86**	1.47	-.1648
Pushing	2.33	3.07	.0278

** Subject regressed during TRMI.

TABLE 3

MEAN GAIN, t VALUE AND PROBABILITY OF t FOR TRMI PSYCHOMOTOR SECONDARY AMBULATORY DATABASE.

CBMEPO	Mean Gain	t	P
Run	.64	2.31	.0271
Skip	1.42	4.36	.0001
Move to Even Beat	1.00	1.58	.1747
Move to Uneven Beat	.73	2.67	.0124
Underhand Throw	2.00*	--	--
Overhand Throw	1.64	3.76	.0007
Catch	2.88	5.74	.0001
Continuous Bounce	1.22	2.48	.0181
2-Handed Sidearm Strike	2.11	5.01	.0001
Personal Space	2.00	7.09	.0001
Shoulder Roll	1.56	7.71	.0001
Dynamic Balance	4.00*	--	--
Diverted Balance	1.11	4.77	.001
Trunk/Leg Flexibility	1.71	4.77	.001

* Activity limited to one subject. No basis for statistical comparison.

TABLE 4

MEAN GAIN, t VALUE AND PROBABILITY OF t FOR TRMI PSYCHOMOTOR PRESCHOOL WHEELCHAIR USER DATABASE.

CBMEPC	Mean Gain	t	p
Head Control	.50	1.53	.1705
Sitting in a Wheelchair	.25	1.46	.1639
Postural Adjustment in a Wheelchair	3.00*	2.75	.0137
Posture Maintenance Transfer	.86	2.28	.0401
Reaching for Objects	1.00	2.37	.0418
Grasping Objects	2.00	4.32	.0035
Holding/Carrying Objects	5.00*	--	--
Pushing Objects	2.50	1.73	.1817
Identify Shapes	1.50	2.73	.1817
Fast Self-propulsion	.67	2.35	.0388
Tossing an Object	.86	2.12	.0537
Catching an Object	2.17	5.92	.0001
Flexibility	.57	1.47	.1648
Upper Body Strength	1.00	1.58	.1747
Static Balance Inside Wheelchair	.25	1.46	.1639
Log Roll out of Wheelchair	1.44	2.75	.0137

* Activity limited to one subject. No basis for statistical comparison.

TABLE 5

COMPOSITE PSYCHOMOTOR GAIN DATA IN TRMI PSYCHOMOTOR DATABASES.

TRMI Database	N CBMEPO Measured	E Gain	M Gain
1. Preschool Ambulatory	18/37	56.79	3.15
2. Elementary Ambulatory	19/52	40.88	2.15
3. Secondary Ambulatory	14/44	24.02	1.71
4. Preschool Wheelchair	16/35	23.57	1.47
M	17/42	36.31	2.16