The Relationships Among Sensorimotor Components, Fine Motor Skill, and Functional Performance in Preschool Children

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The purpose of the occupational therapist's evaluation of young children with disabilities may relate to establishing a diagnosis, planning a program, or evaluating a program. Given any one of these assessment outcomes, therapists use a variety of instruments that assess multiple domains of behavior and multiple levels of performance. Recently, Haley (Haley & Baryza, 1990; Haley, Baryza, & Blanchard, 1993) proposed a conceptual framework for motor assessment that organizes information gathered during evaluation into different levels. The Motor Assessment Outcomes Model (Coster & Haley, 1992; Haley & Baryza, 1990) is a hierarchy that ranges from foundational motor components and patterns and motor skills to functional motor activities and mobility-dependent social roles. The hierarchy is congruent with the Conceptual Model of Disablement (Nagi, 1991) that describes a continuum from specific, discrete impairments and functional limitations to disabilities and handicaps. These models also support the intervention principle that sensorimotor performance components are basic foundations for the development of motor skills and that discrete motor skills enable the child to function in the environment (Booth, 1980; Case-Smith, 1991, Dunn, 1991, Gilfoyle, Grady, & Moore, 1990; Pratt, 1989).

At the first level of the Motor Assessment Outcomes Model (Coster & Haley, 1992, Haley & Baryza, 1990),

Objective. This correlational study investigated the relationships among sensorimotor components, standardized measures of fine motor skill, and functional performance in self-care, mobility, and social interaction. It also examined which sensorimotor components and fine motor skills were predictors of functional performance.

Method. Thirty preschool children with motor delays were evaluated with tests of in-hand manipulation, tactile defensiveness, stereognosis, grasping strength, and fine motor skill. Parents of the subjects were interviewed with the Pediatric Evaluation of Disabilities Inventory. Correlational and regression analyses were computed.

Results. Significant correlations were found among sensorimotor components and discrete fine motor skills as measured on standardized observational tests. Few correlations emerged between foundational components of fine motor skill and functional performance in self-care, mobility, and social function.

Conclusion. Lack of significant relationships among the variables, all of which were aspects of functional performance might be due to the difference between judgment-based and observational evaluation, the influence of the environmental context on the child's performance, and the influence of cultural values on the opportunities afforded to the child.
therapists analyze sensorimotor components such as strength, postural reactions, isolated muscle control, specific motor patterns, and tactile discrimination. These sensorimotor components reflect the child's underlying physical capabilities and provide information about integrity of the central nervous system. The underlying performance components have been described as "intrinsic enablers of performance" (Christiansen, 1991, p. 18).

At a higher level of the model (Goster & Haley, 1992; Haley & Baryza, 1990), assessment reveals the child's ability to integrate foundational sensorimotor components into effective motor schemes or skills (Ayres, 1979; Dunn, 1991; Gilfoyle et al., 1990). Motor skills require proficiency in developmental tasks and are often assessed with standardized testing protocols. Standardized developmental motor tests provide information about the child's ability to perform specific motor tasks and often require that the child combine underlying motor abilities with perceptual and cognitive abilities. For example, standardized tests may include items that involve tracing or copying as a measure of visual-motor skill.

At the highest level of the model (Goster & Haley, 1992; Haley & Baryza, 1990), the child's functional performance (i.e., self-care, mobility, and social interaction), relates to his or her ability to engage in appropriate social roles (e.g., attend preschool, play with peers, participate in family recreation). Social roles and functional performance are highly influenced by context or variables in the environment; therefore, they should be measured within the child's environment (Linder, 1983) or from the perspective of caregivers who observe the child in a variety of social and physical contexts (Haley, Coster, Ludlow, Haltiwanger, & Andreloos, 1992). Functional performance results from the reciprocal transaction of the person and the environment. For example, a child with autism may function exceptionally well in play with siblings at home but have great difficulty with peer interaction in the classroom. The availability of adaptive equipment and the assistance of caregivers may be critical to the child's functional performance: Equipment, such as wheelchairs and orthoses, and environmental modifications, such as low heights for tables and chairs, can greatly improve the functional performance of children with motor impairments.

As a parallel hierarchy, the Conceptual Model of Disability (Haley, 1992) is based on the classification system of disability. The terms impairment, functional limitation, and disability reflect distinct levels of disablement as they affect daily living skills (Christiansen, 1991). When these terms are applied to motor function, the lowest level, impairment, refers to dysfunction or delay in sensorimotor performance components. Specific impairments include deficits in strength, coordination, movement efficiency, endurance, balance, and biomechanical aspects of movement, such as joint mobility (Campbell, 1993). Functional limitation refers to the inability to perform specific tasks or skills (Nagi, 1991). Functional limitations in the child are defined by delayed achievement of discrete, developmentally appropriate skills, such as those measured by normed or criterion-referenced tests (items, such as stacking blocks and drawing a circle). Disability, as defined by Nagi (1991), refers to delayed or dysfunctional performance in important functional activities related to social roles. The context of daily life becomes an important aspect in assessing disability. Emphasis is placed on the transaction of the child and the environmental variables that enable the child to function in developmentally appropriate roles. In this model, disability can be conceptualized as dysfunction in self-care, mobility, play, or other social interactions (Haley et al., 1992). The relationship of the child's impairment, as measured by motor performance and motor control components, to degree of disability has not been identified (Haley & Baryza, 1990).

The concept that motor components, motor skill, and functional performance represent a hierarchy implies that lower levels of performance influence higher levels. If the practice of occupational therapy is driven by the principle that foundational sensorimotor skills are the basis of the child's ability to function in the environment, then core sensorimotor components should be significant predictors of functional performance.

The purpose of this study was to describe the relationships among the levels of the Motor Assessment Outcomes Model (Goster & Haley, 1992; Haley & Baryza, 1990) and to validate its use as a hierarchy of motor outcomes. Increased understanding of this model and the relationship among these variables is important in guiding therapists in use of the model and in developing patient intervention approaches that result in optimal functional outcomes for children.

Method

Sample

The sample was composed of preschool children with mild-to-moderate perceptual motor delays who received occupational therapy and special education through the public school system. Six occupational therapists in Central Ohio identified preschool children who received their services and met the following criteria: chronological age of 4 to 6 years old, fine motor delay of two standard deviations or more on the Peabody Developmental Motor Scales-Fine Motor (PDMS-FM) (Folio & Fewell, 1983), and cognitive skills at 4 years old or older as measured by a developmental curriculum. Of the 42 children identified, 30 (18 boys and 12 girls) children from eight different preschools received parental permission and completed the testing. The diagnoses of the children were developmental delay (22 children), spastic diparesis cerebral palsy (3 children), fragile X syndrome (1 child), and mental retardation (4 children). The age range of the
sample was 3 years, 10 months to 6 years, 0 months, with a mean age of 4 years, 10 months. One child, who was below the age criterion (3 years, 10 month) was admitted to the study because she matched the other criteria and successfully completed the testing. Four subjects were African-American, and 26 were Caucasian.

Instrumentation

To investigate the validity of the Motor Assessment Outcomes Model (Coster & Haley, 1992; Haley & Baryza, 1990), three levels of function were assessed. The tests used to measure each level of the model are presented in Figure 1. At the foundational level, it was deemed important that both sensory and motor components be considered as variables that predict the child's function.

Sensorimotor components. The sensorimotor components evaluated were selected on the basis of their sensitivity to the skills that emerge during the preschool years, their match to the developmental ages of the subjects, and assumptions from the literature regarding the underlying components of fine motor skill and functional performance (Bly, 1994; Bochne, 1988; Case-Smith, 1991; Exner, 1989, 1992; Gilfoyle et al., 1990).

In-Hand Manipulation was measured by having the child turn or rotate a 1-in. peg 180° in his or her fingertips. This skill has been called complex rotation (Exner, 1992). The testing procedure has been previously described in Case-Smith (1991, 1993). In the object rotation test, the child was asked to prehend a 1-in. peg from a pegboard using the preferred hand, rotate it end to end by turning it on its head, and return it to its original peg hole. Two timed scores were obtained for each child as he or she turned 5 pegs. The test was given twice and times were added to provide a summary score. The number of times that the child dropped or stabilized the peg on another surface was also totaled as a drop score. Standard scores were computed for the time summary score and drop scores and were combined into a composite score. Both summary scores and composite scores were used in the analysis.

Grasping Strength was measured with a bulb dynamometer. The highest score of two attempts was used in the analysis. Strength was recorded in pounds of pressure. Only the strength of the preferred hand was measured.

Stereognosis was evaluated with the Manual Form Perception test of the Southern California Sensory Integration Tests (Ayres, 1980). Described as a measure of tactile discrimination and form and space perception (Ayres, 1980), the test measures stereognosis by scoring the child's accuracy in identifying shapes with his or her hand (through tactile, proprioceptive, and kinesthetic processing). The test, which was originally normed on children 4 to 8 years old, requires that the child point to the form on a stimulus card that matches the form in his or her hand. The test has been revised as part of the Sensory Integration and Praxis Tests (Ayres, 1989); however, the items of the original test seemed to be more suited for 4-year-olds and were therefore used in this study. The items also seemed to have greater sensitivity and reliability than those in other standardized tests of stereognosis (e.g., the Miller Assessment of Preschoolers [Miller, 1982]). The number of times that the child correctly identified the forms within his or her hand was recorded and used in the data analysis.

Tactile Defensiveness was rated by the therapist who administered the sensorimotor component tests. The child was rated on a 0–2 scale, with 0 indicating that no defensiveness was exhibited, 1 indicating that one instance of mild discomfort was demonstrated, and 2 indicating that two or more behaviors or two or more remarks that indicated tactile defensiveness were demonstrated.

Fine Motor Skill. Discrete fine motor skills were measured with two standardized tests. The PDMS-FM measured grasping patterns, eye-hand coordination, bilateral hand use, and manual dexterity. This test is widely

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**Figure 1.** Motor Assessment Outcomes Model applied to fine motor skills.


used by therapists and has strong evidence of concurrent and construct validity (Campbell, Wilhelm, Phillips, & Salton, 1988; Palsano, 1995). A second test, the Motor Accuracy (MAC) test of the Southern California Sensory Integration tests (Ayres, 1980), used a tracing task to measure eye–hand control, motor planning, and motor accuracy. Adjusted raw scores, which accounted for the time required to complete the task as well as the child’s accuracy in tracing the line, were used in the analysis.

Functional performance. Functional performance was measured by the Pediatric Evaluation of Disability Inventory (PEDI) (Haley et al., 1992). Scores on the PEDI are based on an interview with each child’s primary caregiver. The inventory rates the child’s capability and caregiver assistance in self-care, mobility, and social function. The parent is asked to report the skills that the child is capable of performing. The assessment is based on knowledge of the patient within his or her home environment and not on performance at one point in time. The parent reports skills that the child may not perform on all occasions (e.g., because of time constraints), but that he or she consistently demonstrates when needed. Most of the items involve fine or gross motor skill. The Self-Care scale, in particular, is based on items that require fine motor skill such as dressing and bathing.

For this study, two subscores were derived. The first subscore—Self-Care with Manipulation—included items from the Self-Care Scale that involved manipulative skills (e.g., bathing and dressing) and eliminated items such as oral feeding and bowel and bladder control that did not require hand skills. The second subscore—Social Function-Play—included three play-related items on the Social Function scale. Those items measured (a) play with adults (i.e., imitation of and turn taking with adults), (b) peer interactions in play (i.e., planning and carrying out play activities with other children), and (c) play with objects (i.e., manipulation and pretend play sequences with objects).

Data Collection

The subjects were tested in one or two sessions. The PDMS-FM scale was administered first by each subject’s primary therapist to identify whether he or she met the criteria for the sample. Within 3 weeks of the PDMS-FM administration, each subject was evaluated on the sensorimotor component and MAC tests (Ayres, 1980) in his or her home by one of three occupational therapists who were trained in test administration and experienced in working with preschool children. Within 2 weeks, the PEDI was administered, five caregivers were interviewed in person, and 25 were interviewed over the telephone.

Data Analysis

The scores described in the previous section were used to compute correlations among the variables. To analyze the ability of scores at one level to predict higher levels of the model, regression analyses (Krebs, 1993) were completed, with fine motor skill (as measured by the PDMS-FM and MAC) and functional performance (as measured by the PEDI) used as the outcome variables. All test scores and chronological ages were entered into the regression equations.

Results

Relationship of Sensorimotor Components to Fine Motor Skill

The correlations between the sensorimotor components and fine motor skill are listed in Table 1. High scores on In-Hand Manipulation (time and composite) and on Tactile Defensiveness represent poorer performance; therefore, correlations with other scores are negative. All correlations, whether positive or negative, indicate that fine motor skills are related to sensorimotor components.

In the regression analysis with pairwise deletion of missing data, In-Hand Manipulation (time score) was the only variable capable of predicting scores on the PDMS-FM ($F = 4.58, p = .03$). In-Hand Manipulation accounted for 65% of the variance on the PDMS-FM. All of the sensorimotor components and age were significantly correlated with the MAC scores. In the regression analysis, both In-Hand Manipulation (time scores) and Stereognosis were predictors of the MAC scores. In-Hand Manipulation was the strongest predictor ($F = 8.57, p = .008$), explaining 28% of the variance. Stereognosis entered the regression equation as a second predictor, accounting for 15% of the variance in MAC scores. The variance in MAC scores, based on combined scores for Stereognosis and In-Hand Manipulation, was 43% (the combined $F$ ratio was 8.04; $p = .003$).

<table>
<thead>
<tr>
<th>Sensorimotor Components</th>
<th>Fine Motor Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Hand Manipulation</td>
<td></td>
</tr>
<tr>
<td>Rotation time</td>
<td>$-0.35^{*}$</td>
</tr>
<tr>
<td>Composite Score</td>
<td>$-0.25^{*}$</td>
</tr>
<tr>
<td>Grasping Strength</td>
<td>$-0.61^{*}$</td>
</tr>
<tr>
<td>Tactile</td>
<td></td>
</tr>
<tr>
<td>Stereognosis</td>
<td>$-0.59^{*}$</td>
</tr>
<tr>
<td>Defensiveness</td>
<td>$-0.39^{*}$</td>
</tr>
</tbody>
</table>


*p < .05 **p < .005
Correlations of Sensorimotor Components and Fine Motor Skill With Functional Performance

Few of the sensorimotor components correlated with functional performance (see Table 2). None of the sensorimotor component measures correlated with Self-Care Function or Self-Care Manipulation function as measured by the PEDI. In addition, no significant relationships emerged between observed performance on fine motor measures (PDMS-FM and MAC) and Self-Care Function or Self-Care Manipulation scores.

In-Hand Manipulation and the PDMS-FM scores were positively correlated with Mobility scores. Of the three variables that correlated with Mobility, only the PDMS-FM successfully predicted Mobility scores in the regression analysis ($F = 10.2; p = .004$), explaining 32% of the variance.

The MAC scores were significantly correlated with Social Function and Play. The MAC successfully predicted the Play scores ($F = 5.353; p = .050$) and accounted for 20% of the variance in scores. Grasping Strength also correlated with the Social Function and Play scores. Although four of the variables correlated with Social Function, only Grasping Strength successfully predicted the Social Function scores ($R^2 = .20; F = 5.623; p = .027$).

Discussion

Correlations Among Sensorimotor Components and Fine Motor Skill

In this sample of preschool children with mild-to-moderate delays in fine motor skill, the strongest relationships emerged at the two lowest levels of the Motor Assessment Outcomes Model (Coster & Haley, 1992; Haley & Banyza, 1990); that is, sensorimotor components were significantly correlated with fine motor skill as measured on standardized tests. The strong correlation between the PDMS-FM scores and In-Hand Manipulation was expected as the PDMS-FM contains items that measure manipulation and eye-hand coordination. The lack of correlation between Stereognosis and PDMS-FM scores may suggest that PDMS-FM items have minimal association with processing of tactile and proprioceptive information. Tactile Defensiveness was significantly related to performance on both the PDMS-FM and the MAC, suggesting that it has a negative influence on fine motor performance. Although numerous authors (Ayres, 1972; Case-Smith, 1991; Roveen & Lane, 1991) have suggested this negative relationship, few studies have documented it.

In-Hand Manipulation, Grasping Strength, and Stereognosis were highly related to the MAC, a paper-and-pencil measure of eye-hand coordination and motor planning. These components may contribute to the child's dexterity in handling the pencil and control of his or her hand movements as measured in the MAC tracing task. Although handling a peg in the fingertips (In-Hand Manipulation) and a pencil in a tracing task (MAC) are quite different tasks, both require eye-hand coordination and precision handling. Both tasks were timed so that accuracy and efficiency were measured. The correlation with Stereognosis may imply that the motor control required in tracing the line is related to perceptual abilities of the hand.

Relationship of Sensorimotor Components and Fine Motor Skill to Functional Performance

Compared to the size of the correlations found between sensorimotor components and fine motor skill, weak relationships existed between sensorimotor components and functional performance. The moderate relationship between In-Hand Manipulation and PDMS-FM and Mobility scores may reflect the children's overall motor capability. Given that all of the measures were within the motor

Table 2
Correlation Coefficients for Sensorimotor Components and Fine Motor Skills With Functional Performance

<table>
<thead>
<tr>
<th></th>
<th>Self-Care (Total)</th>
<th>Self-Care With Manipulation</th>
<th>Mobility</th>
<th>Social Function (Total)</th>
<th>Social Function (Play)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory Motor Components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-Hand Manipulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
<td>-.214</td>
<td>-.10*</td>
<td>-.464*</td>
<td>-.254</td>
<td>-.545</td>
</tr>
<tr>
<td>Composite</td>
<td>.205</td>
<td>.042</td>
<td>-.384*</td>
<td>-.195</td>
<td>-.25*</td>
</tr>
<tr>
<td>Grasping Strength</td>
<td>.211</td>
<td>.106</td>
<td>.191</td>
<td>.154</td>
<td>.584*</td>
</tr>
<tr>
<td>Tactile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereognosis</td>
<td>.269</td>
<td>.255</td>
<td>.276</td>
<td>.232</td>
<td>.108</td>
</tr>
<tr>
<td>Defensiveness</td>
<td>.236</td>
<td>.350</td>
<td>-.190</td>
<td>-.256</td>
<td>-.540</td>
</tr>
<tr>
<td>Fine Motor Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peabody Developmental</td>
<td>.246</td>
<td>.15*</td>
<td>.501*</td>
<td>.335</td>
<td>.582</td>
</tr>
<tr>
<td>Fine Motor Scale*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Accuracy*</td>
<td>.21*</td>
<td>.255</td>
<td>.07*</td>
<td>-.429</td>
<td>.422</td>
</tr>
</tbody>
</table>


*p < .05

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domain, some correlations were expected. In the regression analysis, which included age as a variable, only the PDMS-FM predicted Mobility scores, which probably indicates an association of both measures to general motor function.

The basis of the relationship between Grasping Strength and Social Function is unclear. Grasping strength as an indicator of overall strength could relate to the children's ability to enter into and sustain social interaction. A number of the items in this PEDI subsection related to play with others, initiative in household chores, and independence in community function (outside the home). All of these items require physical capabilities in addition to social skills. The relationship between Grasping Strength and Social Function may also be the expression of a third, unknown variable that influences both, such as general health status and physical size.

The Social Function-Play scores, which included three items measuring social and object play, correlated with Grasping Strength and MAC scores. The ability of the MAC scores to successfully predict Play scores may indicate the importance of eye-hand coordination to preschool play skills. The play items as measured by the PEDI (e.g., imitative play, sustained play, ability to construct and manipulate toys) often involve physical strength and eye-hand coordination; therefore, relationships among these variables were logical.

Often in early childhood practice, occupational therapists emphasize the sensorimotor components of performance with the anticipation that when these improve, functional performance makes an associated improvement. The validity of this assumption would be supported by high correlations between the sensorimotor components of fine motor skill and functional performance as measured by the PEDI. The weak correlations that emerged and the inability of underlying components to predict the children's functional performance as measured by the PEDI were unexpected.

The following are three possible explanations for the weak relationships that emerged when lower and higher levels of the model (Coster & Haley, 1992; Haley & Barry, 1990) were compared. The explanations relate to (a) judgment-based versus observational evaluation methods, (b) differences in the context of performance, and (c) cultural issues that influence the children's level of independence in self-care and social function. 

**Judgment-based versus observational evaluation.** Because the PEDI items were rated from information provided by caregivers, scores reflected the caregiver's judgment and interpretation of a child's performance rather than direct observation of the child performing the self-care, mobility, and social function tasks. Judgment-based evaluation of skills and observational evaluation are subject to different threats to validity (Feldman, Haley, & Coryell, 1990). Observational assessments may lack validity because they are based on observation of the child at one point in time. The accuracy of information from one observation can easily be affected by conditions of the environment (e.g., which may be overstimulating or distracting) or of the child (e.g., who may be hungry or tired).

The validity of the PEDI may be higher than that of observational scales because scores are made by the parents who consider all of the child's behaviors when reporting on the child's function. However, the validity of the PEDI may be affected by the parent's interpretation of the interview questions and the parent's overall impression of the child as, for example, a highly competent or an overly dependent person.

**Context of performance.** Independence in self-care, mobility, and social function is highly dependent on the opportunities presented to a child. The child can only exhibit the level of skill that the environment promotes or allows; for example, the items assessing independence outdoors appeared to be directly related to the child's home environment and neighborhood. In addition, parents may have a comfortable, well established routine that reinforces a child's dependency in grooming, dressing, and bathing. In many of the interviews, the parents explained that they had not given their children the opportunities to exhibit the skills in question. Comments, such as “We are in a hurry in the morning and I dress him,” indicated that independence in self-care was not a priority in many families and that children could have been more independent than their environment allowed them to be. Other parents responded to the PEDI items as if it had never occurred to them to attempt the activity in question with their child. For example, many parents had not allowed their children to attempt to pour liquid from a container or to wash their own hair. The child's primary therapists who reviewed the PEDI results reported that the children's levels of self-care and social function were higher in the classroom than in the parent's report of function at home. Given that the results of the PEDI seem to be highly influenced by circumstances in the child's home environment, lack of correlation with standardized fine motor tests administered in the context of the classroom might be expected.

**Influence of cultural values.** The responses of the parents about the children's self-care function appeared to be influenced by their cultural and familial values. Comments such as “We have always done that for our little ones” and “I have to do up her hair to do it right” indicated that the children's functional performance may be influenced by social and cultural values.

Items on the PEDI Social Function scale, which appeared to be influenced by cultural factors, related to problem resolution, social interactive play, peer interaction, household chores, and community function. On the item regarding household chores, a number of parents indicated that they had given their child responsibility for simple chores at an early age, whereas other parents...
indicated that they had never considered giving their children opportunities to participate in household chores. The importance of social interaction and the opportunities offered to the child to interact with peers may be determined by the degree to which the family members value social interaction. In addition, a family's isolation may be part of their cultural belief system or the result of their being a different ethnic origin than other families in the neighborhood. The influence of these factors became apparent during the interviews and seemed to relate to the parent's caregiving role and the child's performance in self-care and social functions.

Implications for Practice

The weak relationships that emerged among the various components of the Motor Assessment Outcomes Model (Coster & Haley, 1992; Haley & Baryza, 1990) suggest that comprehensive evaluation of all performance areas is necessary to understand functional performance. Identification of specific impairments in sensorimotor components cannot predict functional limitations or the degree of disability that the child will experience in daily living skills. By understanding the transaction between the child's underlying sensorimotor skills and functional performance, the therapist gains insight into an appropriate intervention focus. For example, the child with relative strengths in motor control who has limited self-care and mobility function may lack the environmental opportunities to exhibit the functional skills that are well within his or her capability. The therapist should consider cultural values when helping the caregiver structure greater demands and opportunities in daily living activities.

On the basis of the findings of this study, therapists cannot assume that improvement in foundational sensorimotor abilities will automatically generalize into increased function and success in meeting environmental demands. Rather, creating a match and promoting interaction between the social and physical environment and the child's underlying capabilities provides the key to improving functional performance (Linder, 1993; Zeitlin & Williamson, 1994). Although improving sensorimotor abilities of the child may increase functional skills, changing the context of skill performance by educating the parents or by modifying factors in the environment may have a stronger influence on the child's ability to function. By understanding the variety of contexts in which the child must function and by creating environmental supports within each, the occupational therapist may achieve an optimal level of change in functional performance.

Limitations

Although the sample size limits generalization of the results, external validity is supported by the heterogeneity of the sample. The eight preschools involved were located in rural and urban areas, and the 30 subjects represented a wide range of socioeconomic levels. Another limitation is the focus on only one aspect of motor function (fine motor skill). However, this focus permitted specific relationships to emerge. Analysis of fine motor skill appears to be particularly relevant to the child's capabilities in self-care function. A third limitation was that the sensorimotor components selected for analysis do not represent all of the components that contribute to the child's fine motor skill even though they were believed to be important elements of fine motor skill. A fourth limitation was the narrow age range of the subjects, which does not permit generalization to other ages. This age range was selected because in-hand manipulation skills and critical self-care skills emerge during the 4- to 6-year age range (Case-Smith, 1994; Exner, 1992; Klein, 1986). During the period of skill development, the greatest variability among subjects would be expected, which increases the probability that existing relationships were expressed through the statistical analysis.

Conclusion

The child's functional performance is intricately influenced by the opportunities and challenges presented by the social and physical environments that he or she experiences (Coster & Haley, 1992). The current study demonstrated weak relationships between observational tests of sensorimotor components or fine motor skills and judgment-based assessments of ability in self-care, mobility, and social function. Although many of these functional abilities required manipulative skills, measures of fine motor skill explained almost none of the variance. Complex social, cultural, and environmental factors were not measured in this study; however, the results suggest the influence of these context-specific variables on the basis of interpretation of comments from the subjects' parents and primary therapists. These findings suggest that therapists cannot assume that self-care function will automatically improve along with improvement in sensorimotor components and fine motor skill. Interaction between therapists, teachers, and parents may assist the child in generalizing fine motor skill to functional performance across environments. Collaboration between therapists and caregivers can also assist in establishing functional goals for the child that match the demands and opportunities afforded by the environment. The complexity and the importance of the environment's influence on performance must be acknowledged and understood in order for intervention to effectively improve the child's ability to adapt to and function in those environments.

References


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