A Comparison of Structured Sensorimotor Therapy and Child-Centered Activity in the Treatment of Preschool Children With Sensorimotor Problems

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Key Words: child development disorders • intervention process, occupational therapy

This study compared the benefits of a child-centered therapy approach emphasizing child-initiated play interactions within a structured therapy environment to those of a therapist-directed, structured sensorimotor therapy approach in 12 preschool children with sensorimotor dysfunction. Each child received a pretest, 8 weeks of intervention (A or B) provided once weekly for a 1-hr session, a retest, 8 weeks of intervention (B or A) provided once weekly, and a final retest. A case study methodology was used to evaluate outcome data. Structured sensorimotor therapy was more useful than child-centered therapy in promoting gross motor skills, functional abilities (i.e., self-care), and sensory integrative functions. Child-centered therapy appeared to promote fine motor skills better. Although there were no differences in the two therapies for gains in play, attention, and behavior, variables such as temperament, attentional abilities, family stress, severity of sensorimotor delay, and whether the child had received treatment before seemed to affect which therapy was more beneficial for behavior, play, and attention. The effect of the findings on therapeutic practice is discussed.

A variety of therapeutic approaches have been employed to address the needs of children with sensorimotor problems. Those approaches often used include (a) perceptual-motor strategies such as those developed by Radler and Kephart (1960) that focus on practice of specific perceptual and motor components of skill development; (b) sensory integrative therapy (Ayres, 1972b, 1979), which is based on the premise that the capacity to process and organize sensory inputs is essential for higher level learning and functional behavior (i.e., motor planning, bilateral coordination); and (c) neurodevelopmental treatment (Bobath, 1980; Bobath & Bobath, 1967), which emphasizes the components of posture and movement that constitute functional motor performance and motor control. In actual practice, therapists and educators often blend several approaches to address the specific needs of the child.

A few studies have investigated the relative benefits of sensory integrative therapy, perceptual-motor therapy, and neurodevelopmental treatment. Benefits have been reported in the use of sensory integrative therapy for reading performance (Ayres, 1972a), language development (Ayres, 1972b); Magron, Ottenbacher, McCue, & Keefe, 1981), and motor development (Ayres, 1977). Multisensory treatment strategies (e.g., activities that increase awareness from two or more senses) have been found to be useful in decreasing self-stimulatory behaviors in retarded and autistic children (Bonadonna, 1981; Ottenbacher & Altman, 1984; Storey, Bates, McGhee, & Dycus, 1984). Encouraging results have been reported on the usefulness of perceptual-motor programs (Culp,
Packard, & Humphrey, 1980; McKibbin, 1973; Montgomery & Richter, 1977; Platcher, 1976). In a study comparing sensory integrative therapy and perceptual-motor training in school-aged children with learning disabilities (Humphries, Wright, Snider, & McDougall, 1992), more gains were found in gross motor performance for the perceptual-motor treated group although those children receiving sensory integrative therapy had an advantage in motor planning. In a meta-analysis of quantitative studies on neurodevelopmental treatment, pediatric clients receiving neurodevelopmental treatment (NDT) or some combination of NDT and other related therapy (i.e., developmental skill training) performed better than approximately 62.2% of the subjects who did not receive such services (Ottenbacher et al., 1986).

Although research investigating the differential effects of perceptual-motor, sensory integrative, and neurodevelopmental treatment are important, there is a serious gap between current theoretical thinking about sensorimotor performance and research. The current conceptualization of sensorimotor performance considers that the child organizes sensory information from the environment to use in the execution of motor actions (Lindquist, Mack, & Parham, 1982a, 1982b). The Model of Human Occupation conceptualized by Kielhofner and Burke (1977) further expands on the notion that volitional behavior is organized by the conscious formation of intentional actions. These actions may include movement of the body in space and time, managing the attentional and adaptive processes needed to organize task performance, and communicating intentions and coordinating social behaviors. It has been proposed that actions are organized through developmental and purposeful sequences that require the child to adapt in time and space within the environment (Gilfoyle, Grady, & Moore, 1990).

What becomes important is the interaction of human and nonhuman environmental factors on the child's competence. Treatment, therefore, should be directed not only toward intervention with the child, but also on environmental adaptations that enhance the child's functioning and in finding activities that are most meaningful for the child (e.g., play). In this view, the child is considered an active participant in the intervention process. Play interactions become recognized as an important medium in which the child can practice skills and roles, to explore and integrate sensory information from the environment within the context of meaningful interactions with persons and objects (Lindquist et al., 1982a, 1982b). By observing a child's selection of playthings, how he or she plays, and how long he or she attends, parents and professionals can design intervention strategies that help remediate deficits or strengthen performance and capitalize on a child's interests as well. Such strategies are encouraging to a child and assure her or him of the positive rewards human beings derive from self-support, self-motivation, and self-satisfaction.

Previous investigations of therapeutic interventions and their effect on children with sensorimotor problems have centered on what is done to the child (e.g., sensory stimulation, perceptual training) rather than on the most effective ways to engage children in the therapy process. What are the distinct roles of the child, therapist, and environment in remediating sensorimotor problems? Through the investigation of the relative effects of therapist-prescribed sensorimotor intervention (e.g., perceptual-motor training, sensory integrative therapy) and child-initiated exploration and play during sensorimotor activity, it is possible to examine the contribution and role of child, therapist, and environment in developing sensorimotor functions. This study, therefore, sought to examine how the child's locus of control (internally initiated versus externally directed) affects functional performance.

The purpose of this study was to compare the performance of 12 children's responses in two types of interventions—an intervention approach emphasizing child-initiated sensory and motor exploration during play interactions and a structured developmental approach focusing on therapist-prescribed sensorimotor activities. The measures used in this study included both assessments of developmental performance and qualitative performance.

Method

Subjects

Twelve children from 36 to 71 months of age (x = 53 months) with a range of developmental, motor, emotional–behavioral, and sensory integrative disorders participated in the study. There were 10 boys and 2 girls, all white, from low- to middle-class families in the suburban metropolitan Washington, DC, area. All children except one were full-term and healthy at birth. This subject (Subject B) was premature (32 weeks gestational age) with prenatal complications including respiratory distress. He was diagnosed as hypotonic with motor delay. One child had Down's syndrome (Subject I). All other subjects were diagnosable by their developmental and behavioral symptomatology. Of the 12 subjects, 7 had occupational therapy intervention before participation in the study. Of these 7 children, 6 attended early intervention programs that addressed their overall developmental needs. Five subjects had never been treated before participation in the study.

For inclusion in the study, all subjects had to display at least one of the following: motor delay, sensory processing disorder, or motor planning deficit. Excluded from the study were children with moderate to severe cerebral palsy functioning at less than an 18-month level in motor skills; children with major sensory impairments (e.g., deafness, blindness); children with major orthopedic handicaps (e.g., spina bifida); children with serious...
medical problems; and children with severe cognitive delays with functioning at less than an 18-month level. Definitions and criteria for diagnostic categories are provided in Appendix A. The specific diagnostic classifications of the subjects are shown in Table 1.

**Procedures**

The study was conducted at the Reginald S. Lourie Center for Infants and Young Children in Rockville, Maryland. Six pediatric occupational therapists participated; four had more than 10 years of experience in pediatrics and two had more than 5 years of experience. Four therapists provided the interventions. Each subject was randomly assigned to a treating therapist and was assessed by one of the assessing therapists to avoid examiner bias.

The research design included repeated interventions on the same subject (A-B cross-over design) with randomization of the treatment interventions. Each child received a pretest, 8 weeks of intervention (A or B) provided once weekly for a 1-hour session, a retest, 8 weeks of intervention (B or A) provided once weekly, and a final test. The order of interventions was randomized. Six subjects received intervention A first and the other six subjects began with intervention B. The treating occupational therapist for each subject provided both interventions. To assure fidelity of interventions, treatment sessions were videotaped and reviewed by the other five occupational therapists not treating the case. Before initiation of the study, the treating therapists received training in each intervention approach by the principal investigator (the first author). In addition, ongoing supervision was provided throughout the study to assure that each treatment approach remained pure in its application.

Before the first intervention, each subject received a pretest that evaluated:

- fine and gross motor skills with the Peabody Developmental Motor Scales (Folio & Fewell, 1983)
- sensory integration with the DeGangi-Berk Test of Sensory Integration (Berk & DeGangi, 1983) and the Touch Inventory for Preschoolers (Royeen, 1987)
- play with the Functional Emotional Assessment Scale (Greenspan, 1992)
- attention with observations of out-of-seat behaviors during cognitive testing and inattention during play, social skills, and adaptive behaviors with the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984) and the Child Behavior Checklist (Achenbach, 1989)
- cognitive, perceptual, and language skills with the McCarthy Scales of Children’s Abilities (McCarthy, 1972)
- temperament with the Revised Dimensions of Temperament Survey (Windle & Lerner, 1986).

In addition, parents’ stress was measured using the Parenting Stress Scale (Abidin, 1986).

Two methods were used for measuring change because Stephens and Haley (1991) reported that different approaches may have complementary roles in assessing progress of children with motor handicaps. The two methods were: (a) retesting progress after each trial of intervention A or B and (b) daily observational measures completed by the treating therapist. Pretest measures that were repeated included motor, sensory integration, and play observations. The daily observational measures were based on the short-term treatment objectives developed after the initial pretest. A checklist format was completed by the treating therapist after each treatment session. Appendix B presents an example of the observations used for one subject. Each subject received intervention A, child-centered therapy, and intervention B, structured sensorimotor intervention.

**Child-centered activity (Intervention A).** Child-centered activity is a form of infant psychotherapy that is adapted to the sensorimotor phase of development (Ostrov, Dowling, Wesner, & Johnson, 1982; Mahrer, Levinson, & Fine, 1976). Greenspan (1981, 1989, 1992) has described the elements and mechanics of child-centered activity for parents in what he has termed “floor time” (1992, pp. 445). The approach has also been described in its application to infants and young children with sensory processing, attentional, and emotional problems (DeGangi, Craft, & Castellan, 1991). Child-centered therapy

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**Table 1**

**Diagnostic Classifications of Subjects’ Sensorimotor Disorders**

<table>
<thead>
<tr>
<th>Diagnostic Category</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention deficit</td>
<td>A B C D E F G H I J K L</td>
</tr>
<tr>
<td>with hyperactivity</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Behavioral/</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>emotional problems</td>
<td></td>
</tr>
<tr>
<td>Cognitive delay</td>
<td>X X X X X</td>
</tr>
<tr>
<td>Language delay</td>
<td>X X</td>
</tr>
<tr>
<td>Motor delay</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Fine motor</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Gross motor</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Perceptual problems</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Sensory integrative</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>disorders:</td>
<td></td>
</tr>
<tr>
<td>Bilateral integration</td>
<td>X X X X X X X X X X</td>
</tr>
<tr>
<td>Gravitational insecurity</td>
<td>X X X X X X X X</td>
</tr>
<tr>
<td>Motor planning</td>
<td>X X X X X X X X</td>
</tr>
<tr>
<td>Sensory modulation</td>
<td>X X X X X X X X</td>
</tr>
<tr>
<td>Tactile defensiveness</td>
<td>X X X X X X X X</td>
</tr>
<tr>
<td>Vestibular-postural disorder</td>
<td>X X X X X X X X</td>
</tr>
<tr>
<td>Difficult temperament</td>
<td>X X X X X X</td>
</tr>
<tr>
<td>High family stress</td>
<td>X X X X</td>
</tr>
</tbody>
</table>

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In the child-centered activity, the child was the initiator of all play and the therapist was the interested observer and facilitator. The child was encouraged to engage in activities that he or she enjoyed. The child’s attention span and activity level, rather than an imposed structure or specific task demand presented by the therapist, dictated the direction that the play took. The environment was organized to make toys and materials available that promoted sensorimotor development in a safe area where no prohibitions were required. Extrinsic reinforcement, such as praise, was deemphasized.

Structured therapy (Intervention B). The underlying premise of structured therapy was to teach the child how to attain developmental skills and to develop sensory integrative and motor functions necessary for skill performance. This approach accomplished these goals by using specific handling techniques, prescribed exercises, skills training, and therapeutic activities. The specific objectives of the structured intervention approach were to enhance large motor skills, balance, quality of movement, hand use, eye-hand coordination, self-care skills, sensory integrative skills, and perceptual skills (Clark, Mailloux, & Parham, 1985). For example, motor planning may have been facilitated by directing the child through an obstacle course and providing physical and verbal cues as needed.

The structured motor intervention

• has flexible sequence
• involves exploration and creativity
• is child centered
• is adult guided
• emphasizes dyadic interaction
• improves organizational skills
• has suspended equipment available.

Therapy was provided in an individualized treatment room equipped with suspension equipment (i.e., platform swings, glider swings, hammock nets, and bolster swings), large mobile equipment (i.e., therapy balls and bolsters), tactile exploration materials, fine motor manipulatives, visual-motor materials (i.e., drawing materials, puzzles, and constructional toys), various equipment for balance and motor planning (i.e., balance beams, trampolines, and climbing systems) and materials to develop strength or provide proprioceptive stimulation (i.e., resistive therapy and stretchy, resistive rope pulls). The same materials and equipment were available for both interventions. The child was treated in the same therapy room to avoid confounding effects of setting.

Each therapy session consisted of 50 min of direct therapist-child contact. The parents were able to observe therapy from an observation room through a one-way mirror. Although parent participation is important and critical to most therapy programs, parents of subjects did not receive specific home programs. Each subject’s therapy program was individualized on the basis of specific assessed needs; therefore, some variations in treatment occurred within a given intervention on the basis of the therapy goals for each subject.

Data Analysis

Two levels of data analysis were conducted. First, to establish that there were no order effects, a repeated measures analysis of variance was conducted. Second, to compare the relative benefits of each intervention for each subject, changes in scores after intervention A and B were examined for the following:

• functional performance, including self-care, fine motor, gross motor, and visual-motor skills (through therapist observation measures and scores on the Peabody Developmental Motor Scales)
• Months gained in fine and gross motor skills (through results from the Peabody Developmental Motor Scales)
• Sensory integrative functioning (including postural control and bilateral integration as tested by the DeGangi-Berk Test of Sensory Integration; tactile defensiveness, gravitational insecurity and motor planning through therapist observation measures)
• Behavior, attention, and play (through therapist observation measures).

The criterion for a gain score on the Peabody Development Motor Scales was improvement of 3 or more months in the 2-month span of treatment for one intervention. A gain on the subtests of the DeGangi-Berk Test of Sensory Integration was considered improvement from either a deficit score to at-risk or normal status, or a gain in a deficit score of five or more points. Lastly, a gain on observation measures was considered an improvement in a designated skill in at least 70% or more (i.e., performed skill during six out of eight sessions).

Results

No order effects were found for interventions A and B for the various measures used in this study. Significant progress was obtained for all subjects in number of months gained in gross motor skills for structured sensorimotor therapy ($t = -2.966$, $df = 9$, $p = .016$) and functional skills (i.e., self-care, fine and gross motor, visual-motor) for structured sensorimotor therapy ($t = 2.132$, $df = 11$, $p = .05$). No differences were found for behaviors ($t =
child-centered therapy in contrast to structured therapy. In addition, for sensory integrative motor skills, there was an overall gain of 70% in skills across subjects from structured sensorimotor therapy and a gain of 56% across subjects from child-centered activity. More specifically, seven subjects showed more gain after structured therapy, three more after child-centered therapy, and for two subjects, there were no differences in sensory integrative skills.

In the area of behavior, attention, and play, four subjects responded better to child-centered, three responded better to structured therapy, and another four responded equally well to both interventions. One subject did not have any behavioral difficulties. Of interest was determining whether there were any commonalities among the subjects who responded better to one therapy over the other. Subjects were grouped by diagnostic category (i.e., difficult versus easy temperament; attention deficit versus no attentional problems) and the percent gain was summed across subjects for each diagnostic grouping. These results are presented in Table 2.

In interpreting data from Table 2, a difference in the percent gains between structured and child-centered therapies of 10% or less denoted equivalency. No differences by group were apparent for those subjects with difficult temperament, those with sensory integrative problems with or without behavioral problems, those with high family stress, those who had received treatment before, those with attention deficits, and those with moderate to severe sensorimotor problems. Child-centered therapy was better in helping behaviors, attention, and play for subjects from families with low stress, those with easy temperament, those who had just begun treatment, those with no attentional difficulties, and those with mild sensorimotor problems. Although younger and older children generally did better in child-centered therapy, older children made more gains in behaviors than younger. There were no differences for subjects with low versus normal cognition.

### Discussion

Structured sensorimotor therapy was found to be more useful than child-centered therapy in promoting gross motor skills and functional skills (i.e., self-care, fine motor, gross motor, and visual-motor). In addition, sensory integrative skills improved in more subjects as a result of the structured sensorimotor therapy. Repetition and practice of skills in addition to therapist-directed sensory integrative and developmental motor activities provided during the structured sensorimotor therapy accounted for this result. Current theories of motor learning support the notion that skills are developed through practice and feedback mechanisms that allow a generalized motor program to become developed for related skills (Schmidt, 1975, 1988). During structured sensorimotor therapy, a therapist may employ specific techniques or strategies that facilitate the child's performance (i.e., perceptual-motor training techniques, neurodevelopmental handling techniques). Poole (1991) has described some of the components of motor learning. These include (a) verbal monitoring, demonstration, and physical guidance that help the child learn the goal or intent of the task; (b) trial-and-error practice while practicing specific task components, and (c) presentation of variations in task and situation, which helps the child to consolidate and generalize the skill. These components are employed in a structured sensorimotor therapy approach.

Although gross motor skills were more apt to improve as a result of structured therapy, fine motor skills seemed to improve more as a result of child-centered activity. This finding suggests that different therapeutic strategies are needed to promote fine and gross motor skills. Gross motor skills depend on postural alignment and control, balance, strength, bilateral integration, motor planning, and motivation to move in space. Fine motor skills, on the other hand, depend on coordination, dexterity, and manipulation in unilateral and bilateral hand tasks as well as motivation and drive to seek and explore objects in the environment. The process of experimenting with tools and learning the function of objects through creative play may be key components un-

### Table 2

<table>
<thead>
<tr>
<th>Type of Sensorimotor Problem</th>
<th>Gain Across Subjects (%)</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult temperament</td>
<td>Structured: 66%</td>
<td>CCA = STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 75%</td>
<td></td>
</tr>
<tr>
<td>Easy temperament</td>
<td>Structured: 42%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 66%</td>
<td></td>
</tr>
<tr>
<td>Sensory affective</td>
<td>Structured: 57%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 73%</td>
<td></td>
</tr>
<tr>
<td>Sensory integrative</td>
<td>Structured: 54%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td>without behavioral</td>
<td>Child-Centered: 69%</td>
<td></td>
</tr>
<tr>
<td>High family stress</td>
<td>Structured: 75%</td>
<td>CCA = STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 70%</td>
<td></td>
</tr>
<tr>
<td>Low family stress</td>
<td>Structured: 47%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 72%</td>
<td></td>
</tr>
<tr>
<td>Treated before</td>
<td>Structured: 79%</td>
<td>CCA = STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 75%</td>
<td></td>
</tr>
<tr>
<td>First time treated</td>
<td>Structured: 31%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 67%</td>
<td></td>
</tr>
<tr>
<td>Attention deficit</td>
<td>Structured: 69%</td>
<td>CCA = STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 65%</td>
<td></td>
</tr>
<tr>
<td>No attention problems</td>
<td>Structured: 44%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 88%</td>
<td></td>
</tr>
<tr>
<td>Low cognition</td>
<td>Structured: 54%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 69%</td>
<td></td>
</tr>
<tr>
<td>Normal cognition</td>
<td>Structured: 57%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 73%</td>
<td></td>
</tr>
<tr>
<td>Younger</td>
<td>Structured: 45%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td>(36–54 months)</td>
<td>Child-Centered: 57%</td>
<td></td>
</tr>
<tr>
<td>Older (55–72 months)</td>
<td>Structured: 69%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 86%</td>
<td></td>
</tr>
<tr>
<td>Sensorimotor problems</td>
<td>Structured: 44%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td>Mild</td>
<td>Child-Centered: 87%</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Structured: 83%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 75%</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>Structured: 50%</td>
<td>CCA &gt; STR</td>
</tr>
<tr>
<td></td>
<td>Child-Centered: 58%</td>
<td></td>
</tr>
</tbody>
</table>

Note: CCA = child-centered approach, STR = structured approach.
derlying hand function. Once a child becomes interested in tool use through child-centered play, specific handling techniques may then be introduced to refine prehension patterns and bilateral hand use.

No definitive findings were found for the areas of behavior, attention, and play. Children with difficult temperaments benefited equally from both therapy approaches, whereas children rated as having easy temperament did better with child-centered activity. Typically, children who are considered to have difficult temperament are more demanding and less adaptable with a greater tendency for behavioral difficulties (Barron & Earls, 1984; Himmelfarb, Hock, & Wenar, 1985). The child-centered activity approach may allow the child to exert autonomy and control over the environment, to organize attention and play schemes, and to seek out environmental stimuli that are more self-organizing. At the same time, the structured therapy approach may provide the child with difficult temperament with an external organization and structure that is useful for developing behavioral control and attention. The treating therapists found it easier to do child-centered therapy with the children with difficult temperament because of the problems they encountered in soliciting the child’s compliance during the structured sensorimotor therapy. Finding a balance between these two approaches is the art of therapy and certainly presents a challenge to therapists in working with the temperamentally difficult child.

Although subjects with sensory integrative and behavioral problems, also termed as sensory-affective disorders, did not show differences in behavior from those subjects without behavioral difficulties, child-centered therapy seemed to be more useful in organizing play and behaviors for both groups. The children with sensory-affective disorders tended to seek high levels of sensory stimulation (i.e., tactile and vestibular-proprioceptive) and engaged in elaborate fantasy play around the sensory stimulation during child-centered activity. This fantasy play may have provided a meaningful context for playing out emotional themes that the child might have needed to master or express. Although the structured therapy focused more on practicing skills, the sensory stimulation that was provided was therapist directed and may not have been intense enough to meet the needs of the children with these difficulties.

Subjects who had received therapy previously showed equal benefit to each intervention in organizing behaviors and play. In contrast, those subjects who received treatment for the first time responded better to child-centered therapy in regard to behaviors and play. Likewise, subjects who were older (4.5 to 6 years) made more gains in behaviors than younger children (3 to 4.5 years). Behaviors such as sitting at the table for fine motor tasks, inhibiting impulsive or disruptive behaviors, and making transitions from one activity to another were easier for children who had experienced therapy before and for older children when in a structured therapy situation. It is likely that developmental maturation affects the child’s capacity to adapt to structure imposed on them by a therapist or teacher.

Although the findings strongly suggest that structured sensorimotor therapy is more useful than child-centered activity in facilitating gross motor skills, functional skills, and sensory integrative abilities and that child-centered activity is more useful than structured therapy in developing fine motor skills, we believe that different processes are tapped by the two different approaches, and therefore, that the majority of children with sensorimotor dysfunction will derive benefit from a combination of each approach. Potential processes we believe are facilitated through each approach are presented in Appendix C.

In practice, the therapy approaches used in this study may be blended or sequenced one after the other for best results. For example, a child with severe motor planning problems may benefit more if a structured therapy approach is used first in the session to help the child develop a plan or idea of how to engage in the task. This approach may be followed by a child-centered approach to help the child generate plans himself or herself and generalize the skills across a variety of tasks. Likewise, beginning a session with a structured approach may be best for a child with severe gravitational insecurity who needs a firm, yet gentle approach to guide him or her in accepting low-to-ground movement. In contrast, a child-centered therapy approach may be selected first for children who are difficult and demanding and who would resist if structure were imposed immediately in the session. The two approaches may also be blended in various ways. For example, a child who resists trying any new skills may be lured to try them if the therapist and child take turns picking an activity (i.e., the child selects a child-centered task, then the therapist selects a structured task).

Many studies investigating the effects of intervention do not yield significant results because the measures focus on developmental competence. More than 66% of our sample made gains in fine motor skills and 55% of the sample made gains in gross motor skills that exceeded gains that would have been made due to typical maturation. The four children who made the fewest gains in fine and gross motor skills included two children with mental retardation, one child with severe gravitational insecurity and a strong behavioral resistance to trying motor activities, and the child diagnosed with moderate hypotonia.

**Conclusion**

This study provides preliminary evidence that children with sensorimotor dysfunction benefit from approaches that elicit adaptations to environmental and task demands through the use of play and structured learning.
techniques as therapeutic mediums. In determining how structured sensorimotor and child-centered therapy approaches may best be provided in treatment, the child's specific sensorimotor needs should be carefully evaluated in relation to variables such as age, cognition, temperament, family stress, and severity of handicap. The data lend support for theoretical models of human performance emphasizing adaptation to the human and nonhuman environment, and motor learning that stresses the importance of developing motor programs through practice and directed feedback. Further research is needed on larger samples to determine whether the findings can be replicated and applied to different settings and service provision models.

Acknowledgments

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Appendix A
Criteria for Diagnostic Classifications

1. Attentional deficits:
   A high incidence of out-of-seat behaviors during administration of the McCarthy Scales and a short duration of sustained attention during relational play are the two criteria for an attentional deficit for preschool children (see Ruff, 1990 for specific criteria).

2. Behavioral or emotional problems:
   The child must display either (a) a total test score falling in the deficit range on the Child Behavior Checklist (Achenbach, 1987); or (b) a standard score falling in the deficit range on the Socialization subscale of the Vineland.

3. Cognitive delay:
   A cognitive index of less than 80 on the McCarthy Scales of Children's Abilities.

4. Language delay:
   A verbal scale score falling below one standard deviation on the McCarthy Scales of Children's Abilities.

5. Motor delay:
   A motor delay constitutes a score falling below one standard deviation on the Peabody Developmental Motor Scale, fine or gross motor scale.

6. Perceptual problems:
   A perceptual scale score falling below one standard deviation on the McCarthy Scales of Children's Abilities.

7. Sensory integrative disorder:
   Criteria for each sensory integrative disorder are presented below:
   a. Poor bilateral integration:
      Score falling in the deficit range on the Bilateral Integration subtest of the DeGangi-Berk Test of Sensory Integration.
   b. Gravitational insecurity:
      Severe fear in movement away from the earth's surface with an inability to sit on a mobile surface, climb on stationary equipment such as a jungle gym, tolerate the feet leaving the ground, or engage in movement stimulation such as swinging, sliding, or spinning.
   c. Motor planning problem:
      Inability to sequence simple everyday motor tasks such as lacing, buttoning, zipping, problems with dressing;
      inability to sequence age-appropriate skilled movements involving motor plans such as skipping, galloping, lacing, severe frustration tolerance with new unfamiliar motor acts; and strong reliance on familiar practiced activities.
   d. Sensory modulation:
      Extreme mood changes (i.e., from happy and content to sudden temper tantrum); strong need for intense sensory stimulation but without experiencing autonomic responses; typically become very overwhelmed and disorganized behaviorally as a result of seeking of sensory stimulation.
   e. Tactile defensiveness:
      Deficit score on the Touch Inventory for Preschoolers (Royeen, 1987).
   f. Vestibular-postural disorder:
      Score falling in the deficit range on the Postural Control subtest of the DeGangi-Berk Test of Sensory Integration.

8. Difficult temperament
   Parental ratings of fussy-difficult and unadaptable behavior on the Revised Dimensions of Temperament Survey (Windle & Turner, 1986).

9. High family stress:
   Ratings above the 90th percentile for Total Stress on the Parenting Stress Index.

Appendix B
Example of Weekly Observational Measures Completed by the Therapist

<table>
<thead>
<tr>
<th>Therapy session No:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Therapy provided:</td>
<td>Structured __</td>
<td>Child-Centered __</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Child will explore a variety of textures with his or her hands and feet.
   a. Touched textured surfaces with feet, put textured socks on feet, or submerged feet in textured objects?
      Yes  No
      For how long: 0–1 min __ 2–4 min __ 5 min or longer __
   b. Touched variety of textured toys (wet fingers, velcro, light tickly textures) with hands?
      Yes  No
      For how long: 0–1 min __ 2–4 min __ 5 min or longer __
   c. Sought vibrator to calm or organize self in session?
      Yes  No
      For how long: < 5 min __ 6–10 min __ 11–15 min __ 16 min or longer __

2. Child will develop visual-motor skills in constructing a drawing and in copying shapes (i.e., cross), in tracing and drawing activities, and in building block constructions.
   a. Drew a simple recognizable representational drawing?
### Appendix C

**Potential Processes Tapped by the Structured and Child-Centered Therapy Approaches**

**Domains of Behavior and Processes Tapped by Each Approach**

#### Motor:
- **Child-Centered:**
  - Motivation and drive to move
  - Self-generation of planned actions

#### Structured:
- Mapping of body movement in space
- Practice of motor actions in context of play schemes
- Sequencing, timing, and planning of motor actions
- Finding pleasure in motor activities
- Developing components of posture and movement

### Structured:
- Motivation and drive to move
- Practice of actual skill performance
- Sequencing, timing, and planning of motor actions
- Eye-hand coordination
- Balance, strength, and postural alignment and stability
- Developing components of posture and movement

#### Sensory Integration:
- Child-Centered:
  - Seeking sensory stimulation needed for self-organization of behaviors, attention, and motor acts
  - Developing ideation and planning of motor actions in context of play
  - Organizing motor patterns in relation to demands of activity
  - Developing comfort with tactile-proprioceptive and vestibular experiences that occur in everyday activities

#### Structured:
- Practicing postural control and balance
- Learning components of bilateral integration (sequences, patterns)
- Learning components of motor planning through external structure provided by therapist
- Accepting and making use of sensory stimulation directed by therapist
- Monitoring and controlling behavioral responses to sensory input

#### Attention:
- Child-Centered:
  - Learning to use organization inherent in environment to focus attention
  - Learning to regain attention for tasks attended to only briefly, particularly when no new activities are introduced
  - Expanding on actions in a particular task and thus prolonging attention
  - Showing ability to gain and maintain attention for independent play
  - Prolonging attention in response to environmental and therapist demands

#### Structured:
- Modifying actions in response to verbal/gestural feedback
- Internalizing therapist feedback to self-monitor actions
- Prolonging attention in response to environmental and therapist demands

#### Social-Emotional:
- Child-Centered:
  - Improving signal reading and giving
  - Developing individualization/ego differentiation
  - Developing autonomy and control
  - Showing self-actualization and sense of mastery
  - Expressing emotional themes and behaviors
  - Showing confidence in self as resourceful for own needs
  - Developing and expressing play themes with another person

#### Structured:
- Behavioral inhibition of impulsivity, unsafe, aggressive, or destructive behaviors in response to therapist feedback
- Accepting structure and limits
- Responding to demands/requests of others
- Showing sense of accomplishment and mastery
- Expressing emotional themes within the context of a specified task

---

**Domains of Behavior and Processes Tapped by Each Approach**

<table>
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<tr>
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<th>Structured</th>
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<tbody>
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**Appendix C**

With verbal direction __________
From a concrete simple drawing __________
What did he or she draw? __________
- b. Copied simple shapes (i.e., cross, circle with dots inside, etc.)? Yes ___ No __________
- c. Drew within a path of lines or traced a shape on the line? Yes ___ No ______
- d. Built a block bridge or similar block construction from a model? Yes ___ No ______

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**Functional Skills:**
- Child-Centered:
Developing interest and motivation to do everyday tasks
Developing drive to express self through various mediums
(i.e., drawing)
Experiencing with tools, materials to learn their functions
Transferring learning from other settings and contexts
Developing visuospatial skills in environment
Showing creative expression through play, art, movement, and other activities
Developing more complex levels of play
Structured:
Practicing self-care skills
Developing perceptual and visual-motor skills needed for learning
Transferring skills learned in therapy to school and home

References


