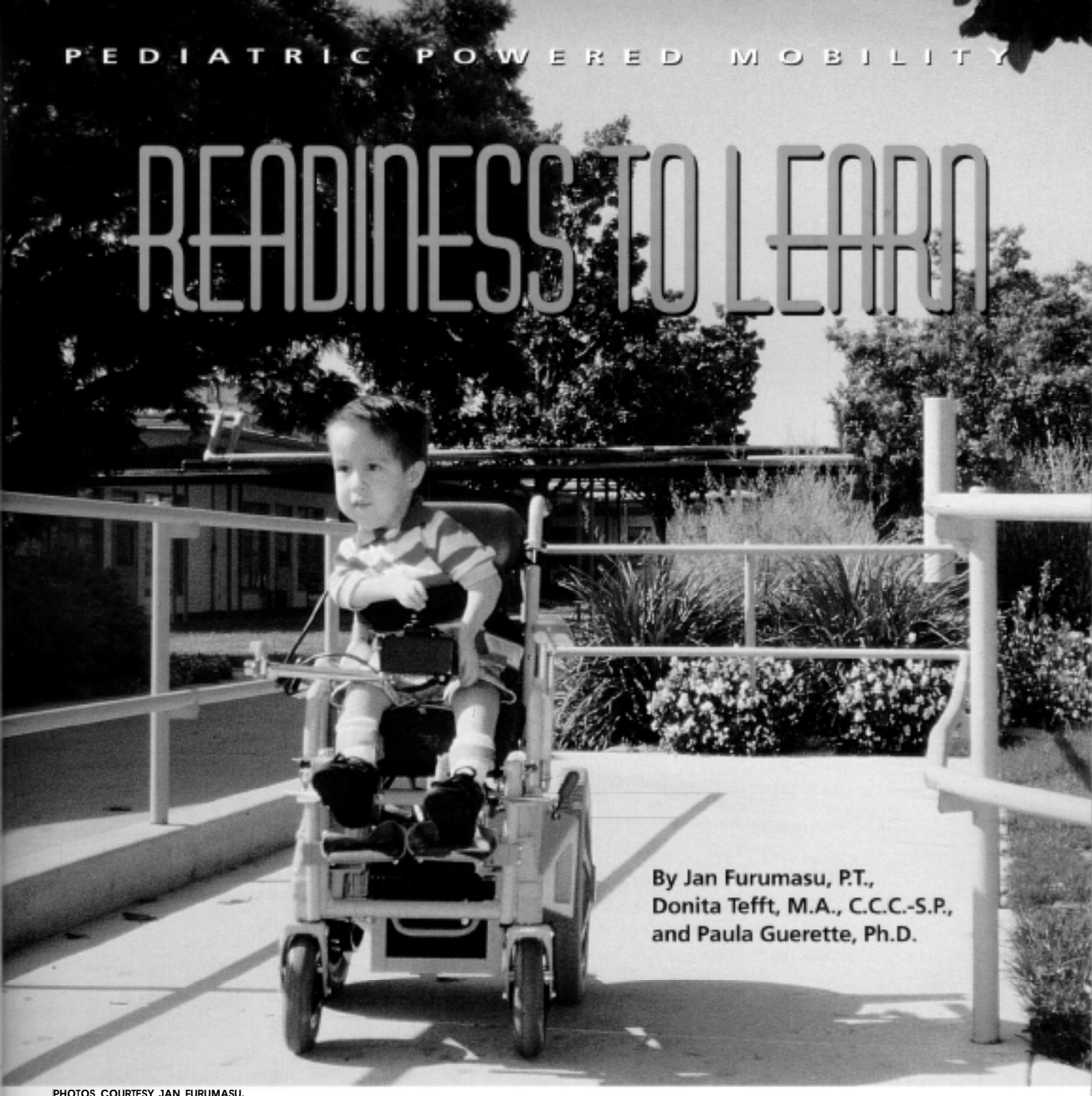
READINESS TO LEARN



By Jan Furumasu, P.T.,
Donita Tefft, M.A., C.C.C.-S.P.,
and Paula Guerette, Ph.D.

PHOTOS COURTESY JAN FURUMASU.

C.B., a 24-month-old boy with a cervical spinal cord injury, learned to safely operate a powered wheelchair after six one-hour sessions. He mastered the difference between fast and slow by holding his sister's hand as she walked down a sidewalk. He learned directional control by following pigeons on a patio, playing "follow the leader." J.S., a 30-month-old boy with arthrogryposis, also spent six one-hour sessions in a powered wheelchair. He mastered going forward and veering to acquire objects he wanted. However, during the training, he never learned to stop without hands-on assistance. continued on p. 32

POWERED MOBILITY

Researchers **worked with each child to assess communication and cognitive skills.**

What were the differences between the two boys that resulted in different powered wheelchair mobility skills? This was the question researchers at Rancho Los Amigos Medical Center in Downey, Calif., addressed in a five-year project funded by the National Institute on Disability and Rehabilitation Research. The project originated from clinicians' desires to better quantify the skills necessary to functionally operate a powered wheelchair and to improve the trial-and-error approach commonly used to determine readiness for powered mobility.

Independent mobility allows young children with physical disabilities to be more fully integrated into appropriate educational programs and can lead to enhanced psychosocial and cognitive development. Identifying cognitive skills influential in the functional operation of a powered wheelchair aids clinicians in the decision-making process when prescribing a powered wheelchair. Therapists and families can also target and develop these important cognitive skills early in the child's developmental program through appropriate developmental play activities.

Various factors influence a child's ability to learn powered mobility skills. Some factors are consistent motor access, cognitive developmental readiness, sorimotor integration skills, and temperament, which includes attentiveness, persistence and motivation. Since there is little research on powered mobility skills in the very young child, the project narrowed its focus to investigate cognitive developmental skills and their relationship to readiness to learn functional powered mobility skills.

The family can play a large role in developing cognitive skills crucial to operating a powered mobility device.

The Study

Twenty-six children between the ages of 18 months and 36 months participated in the study from November 1990 to November 1995. To minimize the influence of sensorimotor integration problems on powered mobility, children with diagnoses that impair primarily physical abilities took part. The diagnoses included arthrogryposis, spinal muscular atrophy, congenital myopathy, spinal cord injury, polio, burn/amputee an osteogenesis imperfecta.

To determine which cognitive developmental skills were more influential in learning to operate a powered wheelchair, an assessment battery was compiled. The original assessment battery consisted of five Piagetian-based scales evaluating cause-effect, object permanence, problem-solving, spatial relations and symbolic play. The Piagetian-based approach was selected as it is a well-researched, validated theory of early childhood development, and has been found to be appropriate for children with a diverse range of disabilities. Another

reason for selection of a Piagetian-based tool was tbat this approach renders specific scores in each developmental scale. This allowed a comparison of scores on each scale to wheelchair performance. Table 1 lists sample test items and the corresponding developmental age for each of the five scales included in the assessment battery.

During the same period that the children were evaluated with the cognitive assessment battery, they also participated in the Powered Mobility Program. The PMP is designed to introduce young children to a wide range of wheelchair skills through exploratory play. The PMP consists of 34 tasks that represent a hierarchy of mobility skills. It begins with spontaneous exploration of movement and progressively introduces tasks to transition the child to more functional skills that are needed to safely maneuver a power wheelchair.

Each child in the study spent six one-hour sessions in the powered wheelchair, progressing at his or her own rate from basic skills to the community interaction. The instructional approach begins with exploratory play, which allows the child to investigate his or her environment. Skills are learned through the child's own trial and error by playing in the wheelchair, and there is very little structure, verbal instruction or direction. The emphasis is on fun and games, as well as positive reinforcement, using the child's curiosity as the motivator. Creative incentives include rolling over water balloons, packing material that pops, and dry, crunchy leaves or just mainly moving about in a nondemanding environment. Instructions typically consist of short phrases such as "Let's go!" "Where's Mom?" and "Where do you want to go?" Besides providing more motivation than specific commands such as "go forward, turn right, now left," these phrases encourage the child to think more independently.

After the child masters the basic

A training video describing the Pediatric Powered Wheelchair Screening Test and the Powered Mobility Program are available through Jan Furumasu, Rancho Los Amigos Medical Center, 7601 E. Imperial Highway, Downey, CA 90242; 310/401-6800; fax: 310/940-7011.

Table 1. Sample Cognitive Test Items

COGNITIVE DOMAIN	DEVELOPMENTAL AGE (MONTHS)	TEST ITEM
Objective Permanence	22	Searches for and obtains object hidden under the last of three screens
Cause-Effect	21	Searches for causal mechanism needed to activate a mechanical toy
Problem-Solving	24	Shows foresight by not stacking solid ring on pole
Spatial Relations	26	Able to nest four cups
Symbolic Play	30-36	Demonstrates sequenced events with familiar toys

skills, he or she needs to develop functional mobility in the community. Community skills are initially introduced in a structured environment, without distractions and with verbal cueing. Once those skills are familiar, the child is introduced to environments that are distracting and unpredictable, such as a busy clinic building or a shopping mall. This type of environment allows the child to demonstrate some level of judgment and safety awareness.

The final session was videotaped and scored according to the amount of hands-on assistance and verbal cueing the child required to safely maneuver the chair. The scoring definitions describe the child's ability to functionally operate a powered wheelchair and could be used to support the purchase of a powered wheelchair. They also objectively describe why a child may not yet be safe in a powered wheelchair and may be more appropriate for another type of mobility device.

To identify the significant cognitive factors influencing functional powered mobility, a regression analysis was performed using the scores from the cognitive assessment battery and the PMP. The spatial relations and problem-solving scales were significant ($p<.05$; The project showed that when the children in the study demonstrated

Spatial **relations, or the ability to make judgments about the relationship between space, size and use of objects, was determined by the ability to nest four cups.**

a certain level of problem-solving ability and an understanding of spatial relationships, it was easier for them to learn to safely operate a powered wheelchair.

The two significant scales make up the Pediatric Powered Wheelchair Screening Test. The PPWST is intended to act as one component of a comprehensive evaluation of a child's readiness for a powered wheelchair. While the cognitive developmental skills identified in the study are important, they are not the only elements involved in successful powered mobility. Temperament, coping skills, sensorimotor integration, parental involvement and environment are also instrumental factors to consider when prescribing a powered wheelchair.

Cognitive developmental skills are not the only elements involved in successful powered mobility.

The researchers have recently been awarded another three-year grant to conduct further studies on the reliability and validity of the PPWST and PMP. The goals of the new project will be to strengthen the PPWST by adding a component to evaluate coping and temperament. The project will also include children with cerebral palsy to ascertain if the findings can be extrapolated to other diagnoses. Five sites in the United States and Canada in addition to Rancho Los Amigos Medical Center will participate in the study: Lucille Salter Packard Children's Hospital, Stanford University, Stanford, Calif.; Easter Seal Program, Carrollton, Texas; John F. Kennedy Medical Center, New Jersey; Children's Seashore House, Philadelphia; and Sunny Hill Cemre For Children, Vancouver, B.C., Canada. I

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Jan Furumasu is a physical therapist in the Rehabilitation Engineering Research Center on Technology for Children with Orthopedic Disabilities and works at the Center for Applied Rehabilitation Technology at Ranch0 Los Amigos Medical Center, Downey, Calif. She can be reached at 7601 E. Imperial Highway, Downey, CA 90242; 310/401-6800; fax: 310/940-7011.

Donita Tefft, MA., C.C.C.-S.P., is a speech-language pathologist currently in private practice in Torrance,Calif. She has specialized for the past 14 years in child and adult cognitive communication disorders and worked as a supervisor for the pediatrics unit at Rancho Los Amigos Medical Center.

Paula Guerette received her doctoral degree in Industrial/Organizational Psychology and has conducted numerous research projects designed to improve services for people with disabilities.