CHAPTER 12

Motor Skills

Beverly Rainforth, Mike Giangreco and Ruth Dennis

It is hard to imagine any functional routine that does not involve some motor activity. Whether playing a game at home with friends, dining in a restaurant, or stapling newsletters in an office, participation involves numerous motor skills. Although motor skills traditionally have been viewed in relation to the normal motor development of a young child, it is useful to consider the functions that motor skills serve. For example, in the routines we just listed, people use motor skills to travel from one geographic location to another. This may involve walking, climbing the steps of a bus, or driving a car. Once at the home, restaurant, or office, the participants use mobility skills to walk between rooms and between areas within rooms. Then they assume and maintain positions that are functional for the activity. They probably sit to eat, but might sit or stand to staple. The functional positioning for the game depends upon whether they are playing cards, croquet, or Twister. Finally, they participate in the core of the activity, which requires motor skills to visually scan and gaze at materials, to manipulate materials, and to eat. Even performing the simplest of the embedded social and communication skills involves some type of motor kills (e.g., smiling when greeted, pointing to a choice).

When we think about the ways we typically perform these functional routines, it seems that participation requires an extensive repertoire of sophisticated motor skills. If we concentrate on the functions that motor skills serve in the activities, however, we can see many more possibilities. We know that the mobility function of walking can be fulfilled by crawling or driving a wheelchair. We know that positioning can be assisted through a variety of adapted equipment. And we know that participation can be elicited through systematic prompts, partial participation, and adaptations. Focusing on the functions of motor skills allows us to see how students with even the most severe physical disabilities can participate in activities. This does not suggest that students do not need to learn or improve motor skills. Generally, walking is faster and more versatile than crawling or driving a wheelchair. Assuming, maintaining, and changing positions independently, and as personal comfort or preference dictate, are preferable to having another person expend time and energy lifting and positioning in costly adapted equipment according to a schedule. And performing at least parts of a routine independently reduces reliance upon personal assistance and adaptations, which are not always available. Therefore, individualized education programs (1BPs) need to achieve a balance between assisting students to fulfill the motor functions that will maximize participation today, and teaching students the motor skills that will increase their independence in the future.

Many children with moderate and severe disabilities achieve the typical "motor milestones" at a slower rate, but follow the normal sequences. It is fairly common for these children to receive motor skills instruction incidentally and in functional

contexts. Other children have more severe or multiple physical disabilities, including cerebral palsy, in which motor development is disorganized as well as delayed. Spasticity, hypotonia, and primitive reflex patterns interfere with experiencing and practicing normal movement, and hinder motor skill development. Unfortunately, therapists and teachers tend to exclude children with severe and multiple physical disabilities from activities in which they could develop motor skills, because the children do not already perform the motor skills that constitute the activity. Such circular reasoning can produce three outcomes. First, children and adults with severe and multiple physical disabilities receive instruction in "prerequisite" movements and motor skills in isolated and nonfunctional contexts where there is no clear purpose for performing the tasks. Second, instruction is episodic, so they do not have enough practice to learn the motor skills. Third, they rarely reach the criterion skill levels, so they never "earn" the right to participate actively in integrated community environments. There is evidence that children with physical disabilities become more interested in activities when they are given a means to participate actively, and when they achieve some control over their environment (Hulme, Poor, Schulein, & Pezzino, 1983). Therefore, whether a student has moderate motor skill deficits or severe and multiple physical disabilities, it is essential that teachers and therapists provide frequent opportunities for him or her to learn and practice functional motor skills through meaningful activities in normal environments.

OPPORTUNITIES TO USE MOTOR SKILLS

While motor sequences help determine which motor skills the student can realistically achieve, and in what order, natural routines and the functions of motor skills help to define the scope of the curriculum. The routines that occur in the home, for example, present endless opportunities to teach motor skills. When arising in the morning, a person rolls out of bed, assumes an upright position, travels to the bathroom, assumes some functional position in front of the sink, and manipulates faucets, washcloth, soap, toothbrush, toothpaste tube, and other implements. The person travels back to the bedroom, opens and closes drawers and closet doors, removes sleep eat, and puts on clothing for the day. Breakfast may entail cooking, setting the table, and cleaning up, as well as eating. The motor functions of positioning, mobility, manipulation, vision, and eating are clear in these routines.

Family members are important in defining the motor curriculum, since they can describe how motor functions are fulfilled at home, which ways are satisfactory, and whether proposed alternatives will be acceptable. The means used to fulfill motor functions at home may be different from those used in the community. For example, York (1987) found that adults with physical disabilities typically walked (if they could) when in or near their home, but used a wheelchair to travel in the community. The same people often crawled on the floor in their home, especially in the bedroom and bathroom, because crawling was safer and more functional. Parents remind us that adapted mobility and positioning equipment sometimes does not fit the space or atmosphere of a home. Parents also can identify the routines where teaching the child functional motor skills would be most beneficial, and when family members have time to teach. Keeping a log of 2 or 3 days' activities is an effective way for a family to identify their priorities and time constraints (Rainforth & Salisbury, 1988). As the child grows older, the family can provide important information about the motor skills

the child has used in the past, and about the methods and adaptations that have been tried.

In community environments and activities, every routine should be examined for opportunities to use or teach motor functions. How does the child travel to the school, workplace, or other community environment? How does the child travel through the building, and within rooms in the building? Is the child encouraged to use or develop independent mobility? What positions does the child use when participating in the activities? Is the child encouraged to use and improve postural control? Would other positions improve the quality of participation? How does the child participate in the activity itself, and in the set up and clean up? Is the child encouraged to use or improve manipulation, eating, and vision skills? Could/should the activity or materials be adapted to increase participation?

MOTOR SKILL FUNCTIONS

Development of motor skills is considered to follow certain sequences. There are specific skill sequences that delineate the many steps from developing head control to learning to walk, and from grasping objects with a fisted hand to writing with a pencil. These sequences are often analyzed or described in terms of more general patterns of development, which are thought to follow certain progressions: head to foot, gross to fine, weightbearing to nonweightbearing, and proximal to distal (near the body to farther from the body). The "head to foot" pattern reflects the progression of control from the head, to the trunk, and finally to the legs. The "gross to fine" pattern reflects the development of large body movements, such as walking, before refined movements, such as buttoning and writing. The "weightbearing to nonweightbearing" pattern describes that children learn to prop up on their arms before they become skilled at reach and grasp. The "proximal to distal" pattern reflects development of control at the shoulders and hips before control at the hands and feet, as illustrated in the other examples above.

Because the skill sequences in motor development have been studied so extensively, many therapists and teachers now consider the sequences to be prescriptive. with earlier skills in the sequences viewed as prerequisites for teaching later skills. For typical children, however, great variations in the rate and sequence of motor development are considered normal (e.g., learning to walk without ever crawling). Furthermore, motor development does not always follow even the general patterns described above (Horowitz & Sharby, 1988; Loria, 1980). Loria found that children simultaneously worked on proximal and distal, weightbearing and nonweightbearing, and gross and fine motor development in the arm and hand. She also found that children achieved the corresponding motor skills in varying sequences. Although the sequences and patterns that typically occur still provide useful guidelines, such research findings of variations in motor development support motor skills instruction for children with physical disabilities that can and should focus on many areas and levels of development simultaneously.

Although we caution against letting "normal" motor development sequences dictate prerequisites for teaching other motor skills, there are other types of prerequisites to which therapists and teachers need to attend. For example, locomotion, eating, looking, and handling objects all require stabilization of some body parts while coordinating movement of other body parts. If there is insufficient stabilization of body

parts or coordination of movement, the student will be unsuccessful in performing the motor components of the task. In this sense, stabilization and coordination are prerequisites to the task. One way to view motor development sequences is that they reflect progressive improvements in stabilization and coordinated movement, which tend to follow the patterns described above. Positioning, handling, and prompting augment the child's internal motor control, and are faded as the child learns to stabilize and coordinate various body parts. The motor skill functions chart (Chart 12.1) reflects a combination of this stabilization-coordination orientation and the "normal" sequences of motor development. It is organized into these major functions: positioning, mobility, manipulation, oral motor functions, and visual functions.

The motor skill functions chart includes only basic information about motor skill development. Other considerations, such as strength, speed, rate, power, and stamina, are not covered here. Factors such as range of motion, muscle tone, and primitive reflexes, which may limit acquisition of motor skills, have been discussed only briefly. For more extensive information and methods, consult with the physical or occupational therapist assigned to your team or school district.

SELECTING EMBEDDED MOTOR SKILLS

Most activities present far more opportunities for teaching functional motor skills than time and resources allow teachers to address. Of course, your team must first decide whether motor development is even an instructional priority. Not all students need to have goals and objectives identified for this particular area. If it is determined that specific attention should be given to motor skills development, it will be necessary to set priorities for instruction. Where do we begin in the selection process? How do we select priority skills to include in a student's LEP? The following steps are designed to assist you and your team in the selection process. As in previous chapters, the example of Mary Z. is continued.

Step 1: Review the number and type of opportunities available to the student to practice and further develop motor skills.

This step involves determining in *what* activities the student will engage, *where* these activities will occur, and *with whom* the student will participate. If a parent has been keeping a log of routines, time constraints, and other pertinent data be sure to include that information in the review process. From this discussion, the team might identify ways to enrich the opportunities available to use motor skills.

Mary Z.: MaryZ., who has cerebral palsy, in addition to severe cognitive deficits, is involved in many activities including: shopping in the grocery store with peers; using the school library to select, use, and borrow talking books with peers; using the school cafeteria or a restaurant with friends and packaging and labeling equipment at the central supply area of a hospital Note that three of the four activities are activities that Mary might also do with, family members(i.e., using library, grocery store and restaurant) These activities are included in Mary's IEP because her family identified needs related to her participation .Even though these are family priorities, the educational team provides the majority of *instruction*; the family provides opportunities for practice maintenance and generalization

Step 2: Review the motor functions and motor skills the student can currently perform.

This step involves determining the mobility the student uses to travel to and within the area where the activity occurs, the positions the student uses when performing the

Chart 12.1. Motor skill functions

A. Positioning

Functions:

1. Assume and maintain positions for participation (consider typical position for task, environment, opportunities for social interaction, student age, and motor skills)
2. Maintain health, by alternating positions (consider optimal position for safety, respiration, digestion, preventing deformity and pressure sores)
3. Maintain and improve postural control

Skill sequence	Stabilization/coordination	Adaptations (examples)
Head upright Trunk upright Trunk slightly reclined Lying on stomach, propped on arms	Stabilize at head, trunk, all other body parts; fade as child gains internal control, leans on arms to stabilize head Stabilize as needed when child eats, uses hands	Chair with head, forearm, and trunk supports Supine stander Wedge or roll
Sitting Side sitting Indian or ring sitting Long sitting (avoid "W sitting)	Stabilize around shoulders for child to prop on arms Prompt at trunk/hips to push up to side sit from stomach Stabilize at trunk/hips to sit without arm support Fade control (shoulders to trunk to hips) as child gains internal control Stabilize as needed when child reaches, uses hands	Regular chair Adapted chair Corner sitter Bolster chair (above may have tray and must support feet and thighs) Body jacket
Hands and knees	Prompt at hips/shoulders to push up from side sit, to maintain position Fade control (shoulders to hips) as child gains internal control	Bolster Low stool
Kneeling	Prompt and stabilize at hips/shoulders to rise up to kneel, to remain kneeling Child uses hands/arms to push/pull up, hold position Fade (trunk to hips) as child gains internal control	Table/counter Kneeling box
Standing	Prompt and stabilize at hips/knees/ankles to half-kneel then stand, to remain standing Child uses hands/arms to pull up hold position Fade where possible as child gains internal control	Prone stander Supine stander Parapodium stand Standing box Railing Ankle splints

(continued)

B. Mobility

Functions:

1. Travel from one location to another (consider typical mobility for activity and environment, student age and motor skills, efficiency)
2. Maintain health through exercise

Skill sequence	Stabilization/coordination	Adaptations (examples)
Rolling	Prompt at head/shoulders/hips/	Inclined surface
Without trunk rotation	knees; stabilize as needed to limit	
With trunk rotation	flexion/extension	
	Fade as child coordinates limbs, trunk rotation	
Crawling on stomach (commando crawling) with reciprocal arm and leg movement	Prompt around elbows/knees for reciprocal crawling	Scooter board
	Fade as child coordinates reciprocal pattern	
Note: Dragging arms/legs interferes with further skill development; if unable to prompt reciprocal movement, consider alternative forms of mobility		
Creeping on hands and knees with reciprocal movement	Prompt at forehead/chest to maintain position	Low stool with wheels
	Prompt at elbows/knees for reciprocal creeping	
Note: "Bunny-hopping" interferes with further skill development; if unable to prompt reciprocal movement (or prevent hopping by holding the ankles), consider alternative forms of mobility		
Kneewalking	Stabilize at chest/hips	Low walker
	Prompt at knees to step	Stool with wheels
	Child may use hands for support/balance	Kneepads
	Fade as child gains coordination, balance	
Walking	Prompt at shoulders/hips/knees for trunk rotation, reciprocal gait	Walker with hip/trunk support
		Walker/rollator
	Child may use hands for support/balance	Crutches
	Fade where/when possible	Ankle splints
		Parapodium
Climbing stairs	Prompt at knees to step, at shoulders/hips	Elevator
Up, step to step, step over step	to shift weight	At home, may sit on step and scoot up/down
Down, step to step, step over step	Child may hold rail for support/balance	
Alternative forms of mobility		
Pushing a wheelchair	Prompt at elbows to wheel	Extension knobs on wheel
		One-arm drive
Driving a wheelchair	Prompt varies with switches	Switches: toggle leaf, eyeblink, sip-and-puff, hand/foot tread
Riding a bicycle or tricycle	Prompt at knees to pedal, at elbows to steer	Trunk support
		Foot straps
		Training wheels

C. Manipulation

Skill sequence	Stabilization/coordination	Functions	Adaptations
Reach	Stabilize shoulder: prompt above/below elbows to reach; at wrist to open hand	Contact materials for manipulation	Friction-free or inclined surface
Prop on arms	Prompt at shoulders/elbows to reach at wrists to position hand open and flat	Stabilize/support other body parts	Motor power
Push		Move grocery cart, vacuum cleaner, push toy	Switches Adapted handle
Retrieve	Prompt at elbows to pull, at wrists to maintain hold (also see "Grasp")	Bring cup to mouth	
Pull (+ / - grasp)		Pick up telephone Open refrigerator Pull Cart	
Grasp (see types)	Stabilize shoulder/elbow; prevent wrist flexion; prompt at wrist and fingers; traction of object on fingers	Hold materials for manipulation	Wrist splint (functional position)
Gross/palmar (+ / - thumb)	Prompt at base of thumb if thumb in palm	Hold handle, hammer, broom, can, knife Squeeze sponge	Change size/direction of cylinder Grasping mitt Universal cuff
Lateral	Prompt at thumb and first finger Support ulnar side of hand to stabilize, isolate fingers	Hold coins Turn toothpaste cap	
Three-finger	Hold palm open Prompt at thumb and first/second/third fingers	Hold sandwich, spoon, pencil Turn jar cover	Add cylinder (sandwich holder)
Pincer	Hold palm open Prompt at thumb and first/second finger	Hold buttons, coins, small finger foods, jewelry, needle	Splint to hold palm open
Point	Stabilize to shoulder Prompt gross grasp, isolate one finger	Dial telephone Push button on elevator, copier, vending machine	Hold cylinder Use fist Head pointer
Release	Stabilize to shoulder Stabilize arm/wrist Prompt wrist flexion to open fingers	Place materials Throw ball Alternate grasps as manipulate	
Twist	Stabilize, prompt as to grasp and release Prompt at wrist to rotate forearm	Turn doorknob, screwdriver, key	Add cylinder at right angle to push/pull Add lever

Note External stabilization (handling and/or adapted positioning equipment) may be needed at the head/trunk to concentrate on task performance

(continued)

Chart 12.1. (continued)

D. Oral motor functions

Skill sequence	Stabilization/coordination	Functions	Adaptations
Swallowing	Position upright Stabilize at head with chin tucked Prompt intermittent closure at jaw, lower lip Wait for swallow; do not try to prompt	Ingest liquids, foods	Intravenous or tube feeding
Drinking (sucking or sipping)	Position upright, stabilize jaw Prompt tongue inside by nipple on tongue/ cup on lower lip, or wait for retraction	Hydration Socialization	Orthodonture (for jaw closure)
From cup	Stabilize mouth by cup rim on lower lip Prompt by tipping small amount liquid from cup		Cut-out cup
From straw	Prompt by placing straw on tongue, squeezing small sips from bottle		Sports bottle Pump cup
Eating	Position upright, stabilize head/mouth with jaw control	Nutrition Socialization Reciprocal interaction	
Spoon eating	Place spoon on center of tongue; give jaw control (intermittent)		
Biting	Prompt by pressing food down on lower incisors	Remove edible-size piece of food	Grind food Cut food
Chewing	Prompt by pressing food down on lower molars and waiting May prompt rotary	Grind food to size/consistency to swallow easily	Select soft foods Grind food
Speaking	Promote by teaching effective eating/drinking/ respiration patterns	Communication Socialization	Augmentative communication

Note: Eating and drinking always occur in an upright position, unless there are compelling reasons to use alternative positions; external stabilization (handling and/or adapted positioning equipment may be needed at the head/trunk to concentrate on task performance self-feeding combines oral motor and manipulation skill

E. Visual functions

Skill sequence	Stabilization/coordination	Functions	Adaptations
Fixing gaze	Stabilize at head and trunk	Receive information Monitor own manipulation of materials Communicate choices	Illuminate object Use contrast Use other senses
Orienting, shifting gaze, scanning	Stabilize at head and trunk Prompt by turning head	Find people, places, materials in environment Find obstacles in environment View selection of choices	Enter line of vision Redirect line with mirror
Tracking	Stabilize at head and trunk Prompt by turning head/preventing turning	Follow activity (e.g., ball game) Reading	Turn head

activity, and how the student participates in the activity, which may include manipulation of materials, oral motor functions, and/or vision functions. This information is acquired through direct observation, which may be followed by diagnostic assessment. Initially team members observe the student in the actual activities and environments where participation is desired. Observation may include some aspects of intervention, to determine the amount and type of assistance the student may need to perform the various functions in a more normalized way. An important consideration when conducting a motor assessment in public environments is to maintain the student's dignity. Arranging a follow-up "diagnostic" assessment responds to this concern for dignity, and also provides additional opportunities for occupational and physical therapists to incorporate their expertise. The follow-up diagnostic assessment allows therapists to look more closely at factors such as motor development, integration of primitive reflexes, muscle tone, strength, coordination, and range of motion – *as these factors relate to participation in priority activities and environments.*

Mary Z.: The learn may observe that Mary sits during most activities they think standing would be more appropriate. The physical therapist (PT) conducts a follow-up assessment to determine whether standing is a realistic expectation for Mary, which motoric factors interfere, how to reduce that interference, which of Mary's current activities are most compatible (motorically) with standing, what equipment may be. necessary to position Mary, and how to prompt Mary to assume and maintain a standing position. The PT would observe Mary in the natural environments and conduct the diagnostic assessment there as much as possible The follow-up assessment would focus on collecting the remaining information needed to answer questions about standing and other motor skills, as needed for the team to make programmatic decisions In other words the assessment is carried out with a specific purpose in mind

At this point in the assessment process, teachers and therapists may find that norm-referenced motor development assessment instruments have some utility. These instruments typically include items that occur in the course of normal gross, fine, and oral motor development, and reflect increasing levels of motor control in populations of children with no known handicapping condition. Therefore, they provide frameworks for assessing large numbers of related skills and for sequencing instructional objectives. The tools might best be used to guide and record a therapist's observations in natural environments, or an assessment interview with family members. This will help you assess the motor component (e.g., note grasping patterns even if item is not performed "correctly") while ensuring that the assessment materials are functional to the student (e.g., grasp spoon rather than grasp rattle).

Mary Z.: An assessment of Mary's motor skills was conducted in natural settings. A sample of the information gathered in various settings is provided below:

Shopping in Grocery Store *Positioning*: Mary sits in her adapted wheelchair, postural control is sufficient for all tasks. *Manipulation:* She grasps, places in shopping basket, and releases items that are less than 2 inches in diameter, movement is shaky, she does better with stabilization at wrist/arm/elbow; she points to items she can't reach; she opens purse and handles money only with hand-over-hand assistance. *Visual functions:* Mary looks at designated picture in. shopping list, looks at shelves, and looks/points when companion points to object on shelf, she does not scan with visual or physical prompts (Performance in other activities was consistent, follow up assessment indicated that she can track horizontally, but has greater difficulty vertically or diagonally.)

Using the School Cafeteria *Mobility: A* friend wheels her through line; she will wheel 3 feet to table with repeated physical prompts much encouragement and meal on table. *Oral motor functions:* Mary drinks, cats mashed/ground foods without difficulty; she swallows whole foods without chewing.

Packaging and Labeling Equipment in Central Supply Department of Hospital *Positioning:* Mary sits in her adapted wheelchair. (Follow-up assessment indicated that she could stand in a parapodium stander for about 10 minutes before firing; she still can package and label in this position the PT will work on a simplified standing adaptation to use in the central supply department at the hospital.) M*anipulation:* She grasps and places towelette packets in counting jig with verbal prompts, to label bag she needs hand over hand prompts to use thumb fingertip (versus gross) grasp to slide the bag under the electric stamping/labeling machine

The above represent just a few of the motor functions and skills that would occur during Mary's activities. Since Mary has multiple handicaps, each activity in her weekly schedule presents far more needs and opportunities than could possibly be addressed, which brings us to the next step.

Step 3: Determine the priority motor functions and skills that will be Included in the IEP.

We recommend that consideration be given to at least three major criteria: 1) maintaining health, 2) increasing immediate participation in integrated environments, and 3) increasing future participation in integrated environments.

Maintaining Health

Bricker and Campbell (1980) described "surviving and thriving" factors that may be critical to any student's health, and therefore his or her ability to benefit from instruction. Important areas for assessment and intervention include growth, cardiac and respiratory function. nutrition and hydration, seizure control, and medication levels. Although these may be viewed as medical management concerns, educators have important roles in assessment and program implementation. First, teachers assist with assessment through ongoing data collection and communication of findings to medical personnel. Second, educators may assume major responsibilities for implementing health management plans on a day-to-day basis. At a minimum, this would involve monitoring a student and calling the school nurse or therapist when certain signs are noticed, or taking the student to the nursing office for routine services. Frequently, teachers participate more directly by dispensing medication, performing postural drainage, positioning, feeding by mouth or tube, toileting and changing diapers, performing intermittent catheterization, and managing a variety of seizures. Even when these management activities do not include instruction, they need to assume high priority in the daily routine because they allow students to benefit from instruction.

Finally, given that maintaining health is such a high priority, it is appropriate to incorporate instruction into health routines. Whenever possible, students should be taught to monitor their own schedules, travel to health offices, and perform other aspects of the routine independently. Because students with severe physical disabilities tend to have extensive health care needs, determining when and how to incorporate instruction may be challenging. For example, some students are unable to change their own position, but need to be repositioned regularly to prevent deformity and pressure sores. In this routine, instruction might focus on the student moving his or her head, arms, or other body parts in the direction of the move, holding onto the teacher, supporting his or her own weight, or maintaining normal tone (rather than shooting into extension) during the move. Similarly, routines such as changing pant liners offer opportunities to increase range of motion, normalize tone, encourage active arm and leg movement for dressing, roll and push up to sit, and so on. McCormick, Cooper, and Goldman (1979) found that incorporating instruction into caregiving

routines increased the amount of instruction received by students with severe handicaps by as much as 50%.

Increasing Immediate Participation in Integrated Environments

After maintaining health, the primary criterion for selecting instructional priorities is that acquisition of the motor skill would increase participation in typical home, school, and community environments. If a child has multiple disabilities, it is appropriate for objectives to address the entire scope of needs. Questions to help identify priorities include the following:

- Will the skill increase participation in a priority activity or environment?
- Will the skill allow participation in a new activity or environment?
- Will the skill provide the student with (more appropriate) control over the environment?
- Will the skill enhance the student's social integration?
- Is the skill appropriate for the activity and environment where its use is intended, and for the age of the student?
- Will the skill apply to many functional activities and/or environments?
- Will the student have opportunities for repeated practice of the skill in his or her daily routine?

Increasing Future Participation in Integrated Environments

While most objectives will focus on achieving participation immediately, it is also appropriate to identify and teach motor skills that are foundations for greater independence in the future. For example, a child may be able to participate in activities as long as she is fully supported by her adapted wheelchair. Although the adaptation allows her to participate now, it does not encourage her to use the bit of head and trunk control she has or to further develop that control. Improvement in head and trunk control would allow the child to use a greater variety of positions and to use her hands for functions other than trunk support. It might also promote independence in mobility and better ocular control (as for scanning and gazing at choices).

Another child may eat ground-up food independently with a spoon, which can be arranged even in restaurants through selection of food or use of a hand-operated food mill. Future independence, acceptance, health, and quality of life would be increased if the child could eat whole foods. Initially, however, the child will probably resist whole foods, and may gag at the feeling of solid food in his mouth. It may be necessary to teach him to chew, which often requires an adult to hold or move food between the child's molars. If these changes and procedures are introduced, the child will lose independence temporarily. You might also have some concerns about whether instruction of this sort should take place in some integrated environments (e.g., the school cafeteria) for fear that it would compromise the child's dignity. One strategy is to start teaching the child to eat whole foods during a snacktime in a more private location. The child would continue to eat other meals independently in the cafeteria, with a systematic plan to introduce whole foods in this location as essential criteria are met.

Choosing between immediate participation and eventual independence is a difficult decision, since much depends upon the accuracy of long-term predictions. Fortunately, there are few all-or-nothing decisions. Even so, this area is likely to arouse conflict between team members with developmental and functional orientations. Decision making will be assisted by considering the following questions:

- Is the skill part of a valid sequence to achieve independence in the future?
- Will the motor skill apply to many motor functions, activities, and/or environments?
- Does achievement seem likely when the student's age, current motor skills, and prior responses to systematic instruction are considered?
- Can instruction be incorporated into or coordinated with current activities?
- Are restrictive conditions required to teach the skill? If so, is there a less restrictive way to achieve the goal?

Mary Z: Using the criteria above the team agreed that the following motor functions and skills were priorities for Mary's IEP.

Positioning: Improve ability to stand (Mary sits for most activities, so preventing contractures is a concern; standing is appropriate for many environments and activities; participation will be enhanced as standing ability improves; feasibility at her work site is being investigated)

Mobility: Wheel own chair short distances. (This will increase independence; it will also improve strength/ coordination in her aims, which may generalize to manipulate functions)

Manipulation: Use pincer grasp. (This will allow more sophisticated participation in many activities; while learning this grasp however, physical prompting will decrease independence.)

Oral motor functions: Chew food. (Health participation and social acceptance are all concerns; to protect privacy, instruction will occur at a separate snack time, rather than in the cafeteria at lunchtime)

Visual functions: Scan choices in a horizontal display. (This will allow Mary to locate desired objects in her environment, as well as to use her communication board more successfully)

The considerations noted above suggest that the team will teach some motor skills directly, but they will use alternative strategies to fulfill other functions.

Step 4: Create adaptations that will enhance participation.

When a student has severe physical disabilities, it is appropriate to consider providing adaptations that will enhance participation, rather than teach all the motor skills required for an activity. When evaluating this option, considerations include the following:

- Will the adaptation fulfill the intended motor function?
- How will the adaptation influence other motor functions and further development of motor skills?
- Will the appearance of the adaptation influence social interactions?
- Is the adaptation simple enough so most people in the student's environment can set it up and provide instruction in its use?
- How much instruction will the student need to use the adaptation?
- What are the costs to buy, maintain, repair, and replace the adaptation?
- Is the adaptation available on loan for an evaluation period?
- Is this adaptation the most beneficial and cost-effective way to achieve participation? (That is, could time and money be spent better by teaching the actual motor skill or by using another adaptation?)

Mary Z.: The *t*eam considered two adaptations that would allow Mary to perform priority motor functions prior to developing the associated motor skills The adaptations also seemed to be less restrictive than physical prompting Finally, each adaptation increased opportunities to practice the desired motor skills, and could be faded systematically to promote skill acquisition.

Pincer grasp: A small plastic splint was made to hold Mary's hand open while allowing her to oppose her fingers it can be applied easily, and is barely noticeable.

Standing: At home and in some' school locations, a parapodium stander will be used; a stander cannot be supplied or transported to the work site, so a belt for hip support was attached to the table in the central supply area where she works; utility and durability of this adaptation will le assessed.

Mary Also uses the adaptation of partial participation extensively. For example, a priority is for Mary to wheel her own chair for short distances, but a companion usually pushes her when longer distances, greater speed, and steering are required.

WRITING GOALS AND OBJECTIVES

The process of selecting embedded motor skills began with identification of activities and environments where motor skills were required for participation. To ensure that motor skills instruction remains relevant, it is recommended that goals address these more general aspects of participation. That is, goals will specify the contexts in which the desired motor skills will be used, and the functional outcome of achieving the motor skill. Goals also need to specify observable learner behavior and describe the direction or type of change that is desired.

Objectives will focus on the priority motor functions and skills that will improve learner performance. Motor objectives, like other behavioral objectives, include three primary components: student behavior, conditions under which the behavior occurs, and criteria for achievement. Each of these components presents particular challenges when writing motor skill objectives. The student's *behavior* is defined in observable and measurable terms. Therapists may find it difficult to define their qualitative concerns related to "normal postures" and "coordination." Refocusing on what the student will be able to do when coordination improves is one way to deal with this problem. The objective includes those *conditions* for performance that are considered crucial or unique. For motor skills, important conditions might include special materials, positioning, manual stabilization of body parts, physical prompts, or procedures intended to prepare the student for participation (e.g., oral facilitation, tone normalization). It is not necessary to include every condition, however, since related information can be included in the instructional procedure. The *criteria* specify the quality or quantity of acceptable performance, and may be stated in terms of latency, duration, frequency, rate, and so forth. For motor skills, it may be appropriate to include a qualitative criterion (e.g., will roll without arching). Criteria include a second component that specifies the stability of performance over time for competence to be confirmed. The considerations described above are reflected in the following goals and objectives for Mary Z.

Goals and Objectives for Mary Z.

Goal

Using the cafeteria at lunchtime, Mary will increase the rate and distance she wheels her chair to travel through the cafeteria line.

Objective

When positioned in her wheelchair 5 feet from her table, and prompted at the elbows, Mary will push her chair to the table (within 2 minutes, for 5 consecutive days): '

Goal

When. packaging and labeling items in the central supply department of Mercy Hospital 2 afternoons per week, Mary will increase her rate and accuracy.

Objectives

When positioned standing with a belt supporting her hips, Mary will stand with her knees straight (for 12 minutes per hour, during 2 hours each day, for 3 out of 3.days).

After wearing a palmar splint for 20 minutes of packaging, Mary will maintain use of a pincer grasp (for the next two opportunities, three of four trials per day, for 2 days).

Goal

During daily situations that involve eating and drinking, (snack) Mary will increase her mealtime skills.

Objective

When Mary is assisted to place a chewable food between her molars, she will close her mouth and chew (for 10 seconds before attempting to remove or swallow the food, during 8 of 10 trials, for 3 consecutive days). (Chewable foods will be licorice, fruit strips, or beef jerky.)

Goal

Mary will purchase two or three familiar items during weekly trips to the grocery store.

Objective

When given physical assistance to stabilize her head and a moving finger to track, Mary will scan items on a grocery shelf (for a distance of 3 feet, on four of five trials, during two trips to the grocery store).

TEACHING IN MEANINGFUL CONTEXTS

Traditionally, students considered to have physical disabilities or delayed motor development have received physical therapy, occupational therapy, and/or adapted physical education services to remediate motor skill deficits. Often, students were removed from the natural environments where they needed to use motor skills, and were taught motor skills in isolated therapy rooms or the "special" gym. They learned to climb steps to nowhere, but not the school-bus steps; they learned to put pegs in a board, but not straws in their milk cartons. More recently, we have started to realize that the most important motor skills to teach are those that occur in students' natural environments and routines. Furthermore, natural environments and routines provide ample opportunities to teach a variety of new and meaningful motor skills.

The value of learning motor skills is directly related to an individual's ability to apply the targeted motor skills to activities and places that are meaningful to them and

perceived as meaningful by others. Thus, the appropriateness of an "isolated therapy model" is being challenged on logical grounds. First, the isolated model is based on a "train and hope" approach (Stokes & Baer, 1977). In this approach, students receive instruction and/or therapy related to motor skills in isolated contexts while staff "hope" that the student will be able to apply the motor skill in functional situations. If isolated intervention takes place, there are three general outcomes: 1) the student will not learn the skill; 2) the student will learn the skill, but not generalize it to functional use; or 3) the student will learn the skill and be able to generalize its use to functional activities. Two of these three outcomes are clearly undesirable and the third is based on generalization occurring.

It may be difficult for students, especially those with severe cognitive impairments, to see the value in "climbing stairs that lead to nowhere." Isolated approaches detract from the development and implementation of shared goals and limit opportunities of the exchange of information among adults that would be necessary to facilitate improved functioning. When students are removed from typical school routines, valuable time may be wasted and students may be unduly stigmatized by the experience. Immediately moving students into isolated learning environments is not consistent with providing service in the least restrictive environment. These are some of the primary reasons why teachers, parents, and therapists are increasingly advocating alternatives to traditional isolated approaches to teaching motor skills.

The term "integrated therapy" was introduced by Sternat, Messina, Nietupski, Lyon, and Brown (1977) to describe a variation of transdisciplinary service delivery where students learn motor skills and receive the input of occupational and physical therapists in the contexts of functional activities in natural environments. Integrated therapy refers to the incorporation of educational and therapeutic techniques employed cooperatively to assess, plan, implement, evaluate, and report progress on common needs and goals (Giangreco, 1986). In recent years there have been a number of research studies supporting the efficacy of integrated therapy (Campbell, Mclnerney, & Cooper, 1984; Giangreco, 1986). Integrated therapy has logical appeal because: 1) students learn motor skills within functional routines, thus eliminating the danger of not generalizing the skill; 2) the motor skill is used in appropriate contexts, thus making it easier for the student to understand the purpose of the activity and making it inherently more motivating; 3) time can be used efficiently by combining the teaching of skills from various curricular domains; 4) parents, peers, and staff have enhanced opportunities to learn from each other, share knowledge and skills, and become released from their traditional roles; and 5) students are allowed and encouraged to remain part of the typical school routine while motor skill training methods are applied in ways that attempt to minimize any stigma associated with specialized services.

Decisions about how and where to deliver motor skills instruction will require individualized decision making. While there may be occasions when separation from the class is appropriate for reasons such as privacy or distractibility, isolated intervention should be considered the last resort, and if implemented, plans should be set forth to reintroduce the student to the natural environment. The importance and potential impact of teaching motor skills within meaningful activities and contexts cannot be overstated. By pursuing this approach parents and professionals can minimize risks to students and simultaneously offer enhanced opportunities for learning and participation.

QUESTIONS AND ANSWERS

Q: The therapist has recommended sensory stimulation for one student. The daily regime includes massage and a variety of tactile and vestibular stimulation. The student remains passive, and I'm not sure how I should measure progress. How can I determine when the program should be changed or when it can be discontinued?

A: The sensory stimulation is meant to help the student organize his motor performance and prepare for functional activities. As a result, the student should tolerate handling or actively engage in some activity more successfully. Positive results might be indicated by improvements in head control, visual fixation, or ability to hold or manipulate objects. Another positive effect might be improved tolerance to handling and movement during self-care or transition routines, such as eating or changing positions. Ask the therapist what the desired effects are for this particular student, and how the stimulation is intended to improve participation in functional routines. Then identify one or two functional activities where positive effects are desired, and measure progress or effectiveness of the sensory stimulation program in relation to these activities.

Q: One of my students requires physical prompting for many activities where he uses his hands, especially eating with a spoon. I had planned to use the prompting hierarchy that progresses from hand-over-hand guidance, to physical assistance, to verbal and/or visual prompts, to independence. But when I give hand-over-hand guidance, the student pulls his hand away. Now where do I start?

A: The physical prompting hierarchy you described is not appropriate for all students. You need to see what type and sequence of prompts work best for your student. The hands are very sensitive, and some students find it irritating to have their hands touched; they may be especially sensitive to light touch. Ask your therapist to help identify other ways and places to prompt this student. He may be able to tolerate the situation better if he touches the object before you touch him. At lunch, try placing the spoon in his hand without touching him, and guiding movement from a less sensitive body part, such as the elbow or upper ann. Holding the spoon near your student's hand and allowing him to initiate the contact may also help him tolerate touch, since he gains some control over when and how the touch occurs.

Q: One of my students has been working on head control over a wedge for years and there is no consistent evidence of progress. Our therapist recommends that we continue to work on head control in this position because it is a prerequisite to other motor skills. What should I do?

A: n a developmental model, head control in prone lying and supported sitting is a skill that is practiced and achieved within the first 6 months of life. It usually comes before other gross motor and functional hand-use skills, so it has been viewed as a prerequisite for further motor development. When a child has difficulty achieving head control, however, it becomes important to look at alternative positions and/or positioning adaptations. Ask your therapist to help you identify other positions where your student can work on head control. Also ask the therapist to select or develop positioning adaptations that minimize the need for head control, so your student can practice "higher level" motor skills in functional routines. Although normal development is a useful guide, many children

do not develop motor skills in the "normal" sequence. You do not have to wait for your student to master one skill in the developmental sequence before starting to teach skills at higher levels.

Q: Where can I find task analyses of functional motor skills?

A: You can write them, based on your own performance or your observation of others. If you will use the task analysis with young children, observe a young child perform the task. Once you have devised your task analysis, you can ask your occupational or physical therapist to help identify the critical elements of a specific movement or motor activity for use in assessment or teaching.

Q: One of my students uses a wheelchair, a scooter board, a bean-bag chair, and a prone stander during the school day. He has been placed full time in a regular fifth-grade class, but because of his equipment, he is usually off to the side away from the other students. How can I get him more involved in group activities?

A: Find out what the purpose of each piece of equipment is and which pieces really need to be used in the fifth grade classroom. Some equipment might he used more appropriately in other locations at school or at home. Some equipment may not be necessary at all. See if you can meet the student's positioning needs by adapting regular classroom chairs, desks, and work areas. Make every effort to have the student use materials and equipment that are unobtrusive and accessible to other students in the fifth grade. Consider age-appropriate colors and accessories to make the adaptations less noticeable.

Q: Our educational team has worked to embed motor objectives into functional goals in the domain areas. The parents of one of my students have asked that we add 30 minutes of daily physical therapy (PT) to their son's education program. What should we do?

A: There are several things to consider. First, consider the outcomes that parents may want when they make this type of request. Discuss the parents' priorities that they hope to achieve through the PT program. These outcomes need to be addressed. You may need to demonstrate how these concerns are or can be addressed in the context of instruction in functional activities. Show the parents how their child will have more opportunities to practice the skill in functional routines than if only practiced in therapy. Devise ways to show that the possible opportunities do actually occur, and make regular progress reports to the parents. Second, sometimes parents don't know what they want their child to achieve in PT, but they know that their physician recommended it. They are concerned that their child may have permanent damage or lose a critical opportunity if therapy is not received. Their concerns may be real. It is up to you to help the parents determine which of the child's many needs are priorities, and how those priorities might best be addressed. This will require communication with all others who are involved in the care of the child, and must go beyond the school-based team. More frequent communication and informal education may be needed. In particular, be prepared to assist parents in articulating the philosophy and methods of embedding motor skills within functional daily routines.

Finally, you may agree that PT is needed, but you think it should be carried out at home; there are only so many things that can be done during the school day. However, many parents have been implementing PT programs since their children were babies. There comes a time when both parent and child need to be relieved of this relationship, so other more appropriate life roles can develop in

the family. Give the parents opportunities to become involved in other aspects of their child's program, and assure them that their child's motor needs will be addressed.

REFERENCES

Bricker, WA., & Campbell, PH. (1980). Interdisciplinary assessment and programming for multihandicapped students. In W. Sailor, B. Wilcox, & L. Brown (Eds.), *Methods of instruction for severely handicapped students* (pp. 3-45). Baltimore: Paul H. Brookes Publishing Co.

Campbell, P., Mclnerney, W., & Cooper, M. (1984). Therapeutic programming for students with severe handicaps. *American Journal of Occupational Therapy,* 38(9), 594-602.

Giangreco, M. (1986). Effects of integrated therapy: A pilot study. *Journal of The Association for Persons with Severe Handicaps, 11,* 205-208.

Horowitz, L., & Sharby, N. (1988). Development of prone extension postures in healthy infants. *Physical Therapy, 68*(1), 32-36.

Hulme, J.B., Poor, R., Schulein, M., & Pezzino, J. (1983). Perceived behavioral changes observed with adaptive seating devices and training programs for multihandicapped, developmentally disabled individuals. *Physical Therapy,* 63(2), 204-208.

Loria, C. (1980). Relationship of proximal and distal function in motor development. *Physical Therapy, 60*(2), 167-172.

McCormick, L., Cooper, M., & Goldman, R. (1979). Training teachers to maximize instructional time provided to severely and profoundly handicapped children. *AAESPH Review, 4*(3), 301-310.

Rainforth, B., & Salisbury, C. (1988). Functional home programs: A model for therapists. *Topics in Early Childhood Special Education,* 7(4), 33-45.

Sternat, J., Messina, R., Nietupski, J., Lyon, S., & Brown, L. (1977). Occupational and physical therapy services for severely handicapped students: Toward a naturalized public school service delivery model. In E. Sontag, J. Smith, & N. Certo (Eds.), *Educational programming for the severely and profoundly handicapped* (pp. 263-278). Reston, VA: Council for Exceptional Children, Division on Mental Retardation.

Stokes, T, & Baer, D. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*(2), 349-367.

York, J. (1987). *Mobility methods used and their effectiveness in home and community environments for individuals with physical disabilities.* Unpublished doctoral dissertation, University of Wisconsin, Madison.

ADDITIONAL READINGS AND RESOURCES

Baumgart, D., Brown, L., Pumpian, I., Nisbet, J., Ford, A., Sweet, M., Messina, R., & Schroeder, J. (1982). Principle of partial participation and individualized adaptations in educational programs for severely handicapped students. *Journal of The Association for the Severely Handicapped*, 7(2), 17-27.

Bigge, J. (Ed.). (1982). *Teaching individuals with physical and multiple disabilities.* Columbus, OH: Charles E. Merrill.

Campbell, P (1987a). Integrated programming for students with multiple handicaps. In L. Goetz,, D. Guess, & K. Stremel-Campbell (Eds.), *Innovative program design for individuals with dual sensory impairments* (pp. 159-188). Baltimore: Paul H. Brookes Publishing Co.

Campbell, P (1987b). The integrated programming team: An approach for coordinating professionals of various disciplines in programs for students with severe and multiple handicaps. *Journal of The Association for Persons with Severe Handicaps, 12,* 107-116.

Campbell, P (1987c). Physical handling and management procedures with students with severe movement dysfunction. In M. Snell (Ed.), *Systematic instruction* of *persons with severe handicaps* (3rd ed., pp. 188-211). Columbus, OH: Charles E. Merrill.

Campbell, P, & Stewart, 8. (1986). Measuring changes in movement skills with infants and young children with handicaps. *Journal of the Association for Persons with Severe Handicaps, 11,* 153-161.

Cohen, M., & Gross, P (1979). *The developmental resource: Behavioral sequences for assessment and program planning* (Vol. 1). New York: Grune & Stratton.

Connor, F, Williamson, B., & Seipp, J. (1978). *Program guide for infants and toddlers with neuromotor and other developmental disabilities.* New York: Columbia University-Teachers' College Press.

Dennis, R., Reichle, J., Williams, W., & Vogelsberg, T. (1982). Motor factors influencing the selection of vocabulary for sign production programs. *Journal of The Association for the Severely Handicapped, 7*(1), 20-32.

Donnellan, A. (1984). The criterion of the least dangerous assumption. *Behavioral Disorders,* 9(2),141-150.

Erhardt, R.P (1975). Sequential levels in development of prehension. *American Journal of Occupational Therapy, 8*(10), 592-597.

Erhardt, R.R (1982). *Developmental hand dysfunction: Theory, assessment, treatment.* Laurel, MD: RAMSCO.

Erhardt, R.P (1987). Sequential levels in the visual-motor development of a child with cerebral palsy. *American Journal of Occupational Therapy, 41(1),* 43-49.

Erhardt, R.P., Beattie, PA., & Hertsgaard, D. (1981). A prehension assessment for handicapped children. *American Journal of Occupational Therapy, 35*(4), 237-242.

Finale, N. (1975). *Handling the young cerebral palsied child at home* (2nd ed.) New York: E.P Dutton.

Fraser, B.A., & Hensinger, R.N. (1983). *Managing physical handicaps. A practical guide for parents, care providers, and educators.* Baltimore: Paul H. Brookes Publishing Co.

Gilfoyle, E., Grady, A., & Moore, J. (1981). *Children adapt.* Thoroughfare, NJ: Charles B. Slack.

Goetz, L., & Gee, K. (1987). Functional vision programming: A model for teaching visual behaviors in natural contexts. In L. Goetz., D. Guess, & K. Stremel-Campbell (Eds.), *Innovative program design for students with dual sensory impairments* (pp. 77-97). Baltimore: Paul H. Brookes Publishing Co.

Guess, D., & Helmstetter, E. (1986). Skill cluster instruction and the individualized curriculum sequencing model. In R.H. Homer, L.H. Meyer, & H.D.B. Fredericks (Eds.), *Education of learners with severe handicaps: Exemplary service strategies* (pp. 221-248). Baltimore: Paul H. Brookes Publishing Co.

Hansen, M., & Harris, S. (1986). *Teaching the young child with motor delays: A guide for parents and professionals.* Austin, TX: PRO-ED.

Leavitt, S. (1982). *Treatment of cerebral palsy and motor delay* (2nd ed.). Boston: Blackwell Scientific Publications.

Levin, J., & Scherfenberg, L. (1986). *Breaking barriers. How children and adults with severe handicaps can access the world through simple technology.* Minneapolis: Ablenet.

Levin, J., & Scherfenberg, L. (1987). *Selection and use of simple technology in home, school, work, and community settings.* Minneapolis: Ablenet.

Lyon, S., & Lyon, G. (1980). Team functioning and staff development: A role release approach to providing integrated educational services for severely handicapped students. *Journal of The Association for the Severely Handicapped, 5*(3), 250-263.

McCormick, L., Cooper, M., & Goldman, R. (1979). Training teachers to maximize instructional time provided to severely and profoundly handicapped children. *AAESPH Review, 4*(3), 301-310.

Morris, S., & Klein, M. (1987). *Pre-feeding skills: A comprehensive resource for feeding development*. Tucson, AZ: Therapy Skill Builders.

Orelove, F., & Hanley, C. (1979). Modifying school buildings for the severely handicapped: A school accessibility survey. *AAESPH Review,* 4(3), 219-236.

Orelove, EP, & Sobsey, F. (1987). Sensory impairments. In F.P. Orelove & D. Sobsey, *Educating children with multiple disabilities: A transdisciplinary approach* (pp. 105-128). Baltimore: Paul H. Brookes Publishing Co.

Rainforth, B., & York, J. (1987a). Handling and positioning. In F.P. Orelove & D. Sobsey, *Educating students with multiple disabilities: A transdisciplinary approach* (pp. 67-103). Baltimore: Paul H. Brookes Publishing Co.

Rainforth, B., & York, J. (1987b). Integrating related services in community instruction. *Journal of The Association for Persons with Severe Handicaps, 12*, 190-198.

Sobsey, D., & Ludlow, B. (1984). Guidelines for setting instructional criteria. *Education and Teatment of Children, 7,* 157-165.

York, J., & Rainforth, B. (1987). Developing instructional adaptations. In F.P. Orelove & D. Sobsey, *Educating students with multiple disabilities: A transdisciplinary approach*(pp. 183-217). Baltimore: Paul H. Brookes Publishing Co.