Applying Contemporary Developmental and Movement Science Theories and Evidence to Early Intervention Practice

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Changes in early childhood science, theory, and best practices for improving outcomes of children with motor delay or dysfunction and their families have evolved rapidly since EI began. Changes in daily early intervention (EI) practice have been more elusive. Closing the gap between knowledge and practice requires EI providers to piece together information from a variety of knowledge streams including early childhood special education, pediatric rehabilitation, and cognitive psychology. The purpose of this article is to create a body of shared, evidence-based knowledge among providers responsible for addressing the needs of children with movement disorders and their families to effect changes in practice. This article discusses the evolution of EI practice models for children with motor concerns; examines related theories, interventions, and outcomes; and presents an alternative model based on contemporary evidence and grounded in dynamic systems theory. Researchers describe existing barriers to implementation of family-centered, support-based practices. Recommendations highlight the need for EI providers to collaborate with families to develop meaningful goals and to recognize and create opportunities for children to engage in high volumes of task-specific activity in a meaningful context. Continued research is required to verify effectiveness of this integrated model for improving child and family outcomes. Key words: dynamic systems theory, evidence-based practice, motor development, early intervention practices, activity, family-centered care, support-based early intervention, pediatric rehabilitation, motor delay, children with disabilities

The importance of providing early intervention (EI) for young children with developmental delay or disability is now highly institutionalized through legislation (Public Law 108-446, 2004) and rarely questioned by policy makers, families, or service providers. There is an increasing demand for EI service providers in all professional disciplines to engage in evidence-based practice and be accountable to families and other stakeholders for the achievement of outcomes that make a meaningful difference in the lives of the children served (Turnbull et al., 2010). Early interventionists face the complex challenge of partnering with families to develop evidence-based service plans for children with motor delays on the basis of limited evidence regarding...
the effectiveness of traditional methodologies and the volume of information that provides alternative perspectives on child development and intervention approaches. Although contemporary developmental science and pediatric rehabilitation literature point to the promise of new approaches, in many cases, interventionists continue to implement more traditional, hands-on, discipline-specific intervention strategies in daily practice, even when the evidence supporting the effectiveness of such strategies remain unclear (Odom, 2009).

Perhaps, what we are facing in EI is the need for a “phase shift,” as defined within dynamic systems theory in relation to infant development. According to dynamic systems theorists, changes in development do not occur at a gradual, steady pace (Thelen, 1995). Instead, old behaviors give way to new behaviors abruptly, when the old ways of behaving no longer meet our needs (Chen, Metcalfe, Chang, Jeka, & Clark, 2008). An example of this phase shift in motor development is the transition from walking to running. To be able to run, we must do more than just walk faster. We must change from a pattern in which 1 foot is always on the ground to 1 in which both feet are off the ground at the same time.

Perhaps, a similar trend needs to occur in the development of EI professionals. For EI providers to adopt new methodologies, 4 things must happen. First, interventionists must be able to reflect on the practices they and their colleagues have been using and evaluate research-based evidence in the context of their own clinical expertise and the values and preferences of the families they serve (Straus, Richardson, Glasziou, & Haynes, 2005). Second, interventionists must believe that implementing contemporary strategies will improve outcomes for the children and families they serve (Menon, Korner-Bitensky, Kastner, McKibbon, & Straus, 2009). Third, they must have specific information about how to translate basic science and theory into realistic practices (Schreiber, Stern, Marchetti, & Provident, 2009). Fourth, they must be able to work together as a part of a collaborative team, understanding that each discipline contributes its own unique philosophy and expertise (Bruder, 2010). Therefore, the purpose of this article is to create a body of shared, evidence-based knowledge among team members responsible for addressing the needs of children with movement disorders and their families. This will be accomplished by describing the evolution of EI practice models; examining-related theories, interventions, and outcomes; and presenting an alternative model based on contemporary evidence and grounded in dynamic systems theory.

**FIRST-GENERATION EI**

**The child-centered, developmental perspective**

Early intervention programs have their roots in early-childhood special education and Medicaid’s Early and Periodic Screening, Diagnosis, and Treatment Program of the 1960s (Meisels & Shonkoff, 2000). While services were initially highly variable (Bailey, Buysse, Smith, & Elam, 1992), the predominant service delivery model focused on providing child-centered, hands-on direct care to eligible children (Guralnik, 1997) on the basis of a developmental framework. For children with motor delays or disability, the primary goals of those services were to discourage or inhibit the use of abnormal or compensatory movement patterns and hasten or facilitate progression along the predictable developmental sequence (Atwater, 1991).

**First-generation theories and intervention strategies**

Neuromaturational theory served as the foundation for this approach, based largely on the work of McGraw (1945) and Gesell (1946). Acquisition of typical motor skills was believed to occur as a result of maturation within the child’s nervous system in a predictable pattern. In this process of maturation, control of movements progressed from the primitive, lower brain centers toward higher centers in the cerebral cortex and movements...
of the developing infant progressed from reflexive, stereotypic whole-body movements toward voluntary, coordinated movements of 1 body part separate from another (Heriza, 1991). The achievement of steps along this progression or developmental milestones served as the standard for typical development. Children who failed to achieve these milestones in a timely fashion, or executed them with poor quality or in an unexpected manner or sequence, were likely to be referred for EI.

On the basis of the neuromaturational or hierarchical perspective of motor development, the early interventionist’s responsibility was to move the child along this sequence, working to improve head/neck control and core stability before progressing to movements involving the lower-body or fine motor activities (Harris, 1997). Therapists used skilled, precise handling methods, such as neurodevelopmental therapy and proprioceptive neuromuscular facilitation techniques, to limit the child’s use of reflexive and other whole-body movement patterns originating at lower brain centers and facilitate “normal” movement patterns. For example, interventionists would facilitate belly crawling before quadruped creeping and creeping before walking. Alternate approaches to locomotion such as scooting on the buttocks were considered atypical and were discouraged. Service providers focused on the child’s problems or risks, while parents complied with therapeutic suggestions and advocated for their children in a manner commensurate with their own feelings of competence (Kolobe, Sparling, & Daniels, 2000). While other theories of child development, including behaviorism, also informed first-generation EI practice, the neuromaturational explanations were most directly linked with the hands-on intervention approaches for children with motor delays (Heriza, 1991).

**Outcomes of first-generation EI**

In a comprehensive analysis of this type of child-centered direct EI services, Guralnik reported short-term improvements for children with cognitive impairments. Long-lasting effects were also significant and dependent upon intensity and specificity of the EI program (Guralnik, 1998). However, for children with motor impairments, systematic review of motor interventions by Harris (1997) did not identify significant improvements in developmentally based motor outcomes. This systematic review influenced service providers, especially physical and occupational therapists to examine the developmental milestone, child-centered intervention strategies. However, the influence of neuromaturationalists is still evident in the continued use of milestone achievement as the primary standard against which a child’s motor development is measured to determine eligibility in the absence of a diagnosed physical or mental condition likely to result in developmental delay (Mott & Dunst, 2006). Although recently developed tools used to assess motor development emphasize the acquisition of real-life functional skills (Snider, Majnemer, Mazer, Campbell, & Bos, 2009), for most children the delayed emergence of motor and other skills are key findings in EI eligibility decisions.

**SECOND-GENERATION EI: FAMILY-CENTERED, SUPPORT-BASED (CONTEXTUAL) MODELS**

As EI services matured, the role of the family in shaping development gained increasing recognition. Family-centered services that characterize the ideal of second-generation services (Guralnik, 1997) are flexible, individualized services based on family needs, emphasizing the strengths of the child with goals created by shared decision making by family members and professionals as equal partners (Dunst, 2002). Consistent with family centeredness, second-generation EI professionals were encouraged to adopt a support-based service delivery model in which the role of the interventionist is to provide or make available the supports that would enable the family to optimize their child’s development (Dunst, 2002). The importance of specialized
hands-on services provided by professionals is downplayed, while skills such as active listening and guiding the family toward resources or the use family routines as opportunities for practice are valued (McWilliam & Scott, 2001). Theoretical support for second-generation EI was primarily based on environmental theories and dynamic systems theories (Guralnik, 2001).

Second-generation theories and intervention strategies

The work of environmental theorists articulated the importance of context in helping to shape motor development in young children (Bronfenbrenner & Ceci, 1994). Bronfenbrenner (1986) identified environmental layers that imposed proximal versus distal influences on the individual. The term mesosystem described the proximal influences of the various settings in which the child directly experiences developmental opportunities, such as the family, home, or daycare settings. Exosystem described the more distal influences of environments from which the child is more removed, such as parental workplaces and social networks, which may support or detract from the parents’ ability to promote their children’s development (Bronfenbrenner, 1986).

Lynch and Cicchetti (1998) built on the work of Bronfenbrenner by adding the transactional concept in which the levels of the environment not only influence the child’s development, but also interacted with one another and with the child’s developmental and adaptive skills. Sameroff and Fiese (2000a, 2000b) emphasize the bidirectional nature of the relationship between children and their environments, recognizing that the child’s learning and performance are not only shaped by ecologic factors, but they also serve to shape the environmental contexts in which the child is developing. Furthermore, the effects of exposure to environmental variables may be cumulative rather than isolated. The transactional conceptualization of the environment expanded the environmental layers of Bronfenbrenner to include the ontogenic or sequential development of the child, the microsystem or child’s immediate environments, the exosystem or neighborhood/community in which the family and child live, and the macrosystem or cultural beliefs and values that get infused into family function (Lynch & Cicchetti, 1998) (Figure 1).

The second main theoretical influence shaping second-generation EI services is the dynamic systems theory, which also

![Figure 1. Proposed interactions between child and multiple layers of environmental context.](image-url)
recognizes the importance of environmental context in shaping motor and cognitive behavior. Believing that neuromaturation could not adequately explain the varied and unpredictable nature of skill acquisition in the development of young children, dynamic systems theorists hypothesized that cognitive and motor development arise out of a dynamic interplay among multiple systems within the developing individual, the task or problem to be solved, and the environmental context in which the individual performs the task (Carr & Shepherd, 1998; Carr & Shepherd, 2000; Gordon, 2000; Thelen & Smith, 1998).

In this model, the brain contributes to, but does not exert, exclusive control over motor development. Thus, in addition to neuromaturation, many variables appear to limit or support the acquisition of motor skills.

According to dynamic systems theory, children move to solve goal-directed problems, such as moving from one place to another or to retrieve or manipulate an object (Von Hofsten, 2009). Constraints or rate-limiting factors are factors that place limits on or constrain motor function, while affordances are factors available to support or promote movement. Examples of constraints include intrinsic factors such as weakness or decreased muscle flexibility and extrinsic factors such as slipperiness of surfaces or the weight of the object being acted on. Examples of affordances include intrinsic factors such as a desire for mastery, while extrinsic affordances would include having an appropriate-size bench available to use when pulling to stand. Systems theorists hypothesize that intervention strategies cannot focus solely on promoting developmental skills, but they must also take into consideration identified constraints and affordances within the child, the environmental context in which the child must act, and the task the child is attempting to perform (Thelen et al., 1991). Effective intervention strategies grounded in systems theory should include, therefore, intrinsic and extrinsic factors with attention to possible constraints and provision of affordances. For example, ensuring that the child has something desirable to reach toward a meaningful problem to solve within the (natural environmental) contexts in which he will need to perform the target behavior of reaching is likely to be more effective than therapist-directed reaching activities in a clinical setting or interrupting the child’s functional reaching efforts to focus on quality of movement. In an ideal support-based world, the interventionist would help the parent set up these scenarios that promote meaningful reaching activity during naturally occurring family routines.

**Outcomes of second-generation EI**

Two decades after the introduction of second-generation EI programming principles, capturing precise information about the general effectiveness of EI services remains challenging because of the variability and complexity in programming and increasing heterogeneity of the families and children served (Bruder, 2010). For children with motor dysfunction and their families, researchers report inconsistent information about parent perceptions of family-centered, support-based EI services. Scales, McEwen, and Murray (2007) reported that, after viewing videotapes of child-centered, direct care and family-centered support-based care provided by physical therapists, parents perceived the support-based approach to be significantly more beneficial to parents, more likely to help the child reach their goal faster, and more stressful to parents than child-centered, developmental care.

Iversen, Poulin Shimmel, Ciaccera, and Prabhakar (2003) compared the attitudes of a diverse group of parents with a multidisciplinary group of providers regarding family-centered EI services (). Parent and provider satisfaction with program effectiveness in increasing understanding of typical child development was similar (87% and 99%, respectively). Program strengths identified by both groups included improved ability of parents to see what their child was learning to do and to be more confident about how their family was helping their child. Parents’ perceived program weaknesses included
knowing how to set goals for their child, knowing how to get their child to cooperate, and knowing more about community resources. Providers’ perceived program weaknesses included valuing time children spent with children who were typically developing and in facilitating support from other parents (Iversen et al., 2003). It is clear that providers need to support and empower families to become collaborative partners in the goal-setting process and to model and allow families to experiment with successful behavior-management techniques once identified for a particular child and family.

Since second-generation approaches emerged favoring transdisciplinary approaches, it is clear that physical and occupational therapists continue to fill roles on the basis of their unique training and expertise that are not shared by other EI providers (Ideishi, O’Neil, Chiarello, & Nixon-Cave, 2010). One important role identified for therapists was that of helping parents and other team members understand reports about children’s health and medical status. However, finding time for therapists to communicate with others was consistently seen as a challenge that interfered with coordination of care between team members. Therapists also reported that time constraints interfered with their ability to communicate with families in ways that supported or affirmed the family’s caregiving abilities. The degree to which therapists adhered to principles of family-centered care differed according to practice setting, with hospital-based therapists tending to focus on disability, while EI therapists had a more holistic view of the child and focused on broader social and community implications of the child’s health. Even within the community of motor therapists, there was conflict regarding how therapists in 1 setting perceived the others’ competency, particularly competency in dealing with complex patients (Ideishi et al., 2010). It is important that, even in the face of personnel shortages, therapists develop a better understanding of the resources available through collaborative teaming and that they are supported to spend time communicating with team members to minimize conflict and improve continuity of care between EI and other providers. Specific evidence regarding the outcomes of models following dynamic systems theory is discussed separately later in this article.

Barriers to implementation

While systems theories provide a strong foundation of support for the use of second-generation approaches, strategies for implementing these theories in daily practice has proven challenging for EI professionals for a variety of reasons. For example, while pediatric physical therapists set a high value on keeping up with current practices and have a positive attitude toward evidence-based practice, they have little confidence in their own ability to critique or interpret research-based findings, particularly statistical analyses (Schreiber et al., 2009). These findings were shared by providers across professional disciplines (Metcalfe et al., 2001).

Researchers have also identified additional personnel-related barriers to implementation of family-centered services for children with motor delay or dysfunction. O’Neil and Palisano (2000) found that while therapists’ believe strongly in family-centered care, they are more likely to base care-related decisions on child characteristics and family considerations than on administrative mandates to engage in family-centered practice. Therapists identified excessive EI documentation requirements, the changeable nature of administrative policies, changes in funding and reimbursement as barriers to engaging in support-based practice (O’Neil & Palisano, 2000). Summers et al. (2005) identified professionals’ lack of preparation and comfort in working with families and lack of administrative support as possible barriers to implementation of family-centered, support-based services (Summers et al., 2005). Iversen et al. (2003) surveyed parents and providers and identified scheduling issues, conflicts with family priorities, and conflicting views of EI services as important barriers to forming collaborative...
BRIDGING KNOWLEDGE AND PRACTICE 1: HIGH-VOLUME, TASK-SPECIFIC ACTIVITY

Importance and characteristics of practice

If EI providers are to overcome these barriers and translate knowledge about human motor development into interventions that will effectively optimize it, they must understand the science at multiple levels. Adolph (1997) proposes the key to motor development, or the common thread that links all levels from neurons to neighborhoods, as “activity” that we define as meaningful, contextualized practice, or experience with the target behavior or skill being acquired (Damiano, 2006). Although Adolph (1997) found that the child’s age, physical size, and amount and type of locomotor experience combine to exert a significant influence on the development and refinement of locomotor skills. The factor that remained significant independent of the others was activity or practice with the target skill (Adolph, 1997).

Children not only need opportunities to engage in activity, but they need lots of these opportunities if new locomotor skills are to emerge (Adolph, Vereijken, & Shrou, 2003). Adolph et al. (2003) found that children cover the equivalent of 10 football fields a day when they learn to crawl and travel an average distance equivalent to the length of 29 football fields each day when they learn to walk to become proficient in these locomotor skills. Investigators have identified important differences in the volume of activity experienced by children developing typically and children whose motor development is delayed or dysfunctional. Bjornson, Belza, Kartin, Logsdon, and McLaughlin (2007) reported that children with cerebral palsy (CP) take an average of 2500 fewer steps per day than their typically developing peers (). Lloyd, Burghardt, Ulrich, and Angulo-Barroso (2010) found that the amount of leg activity seen in children with Down Syndrome (DS) was a significant predictor of the timing of walking onset. That is, infants with DS with high levels of activity at 12 and 14 months of age walked sooner than those with limited leg activity during the same period (Lloyd et al., 2010).

Furthermore, children’s activity must involve the specific movement skill being acquired for new locomotor patterns to emerge (Adolph, Vereijken, & Denny, 1998). For example, children who had been belly crawlers did not crawl on hands and knees or walk upright any earlier or later than children who skipped belly crawling because practicing belly crawling was not task specific enough to influence acquisition of crawling or walking (Adolph et al., 1998). Experiments conducted by Adolph confirmed the earlier observations of Zelazo (1983), who reported that infants who had practiced stepping patterns daily retained the ability to step even after they reached the age at which stepping would be expected to fade away because of integration of the step reflex, though other skills did not necessarily advance. More recently, Heathcock, Lobo, and Galloway (2008) provided another example of the value of task-specific activity in their report on reaching in premature infants in which babies exposed to regular reaching and object-manipulation activity demonstrated significantly more reaching behaviors and object-manipulation time than their premature or full-term peers who were not exposed to similar practice schedules. The influence of practice and contextualized activity also applies to infants with motor delay or dysfunction. Ulrich, Ulrich, Angulo-Kinzler, and Yu (2001) demonstrated that children with DS who received intensive in-home practice involving treadmill stepping while supported by a parent began walking independently 101 days sooner than their peers who were not exposed to treadmill stepping.
Effects of activity on brain development

The effects of practice are hypothesized to be evident not only in the visible behaviors of young children with and without motor delays, but also at the level of the neuron. Sporns and Edelman (1993) have suggested that appropriate, repeated activity causes neurons involved in a specific activity to fire together. As neurons repeatedly fire together, they create networks or synergies that predispose those specific neurons to fire with increasing efficiency, resulting in more efficient and coordinated or refined movement patterns. This premise, known as neuronal selection theory, helps to explain motor development at the level of the neuron. When monkeys successfully repeated a task time after time, their nervous system reorganized in a way that allowed them to perform the task more efficiently. This reorganization is believed to account for the type of motor memory that allows one to get back on a bicycle and ride even after years without practice (Miyashita, Kubik, Lewandowski, & Guzowski, 2008). One important role of EI providers may be to assist families in understanding the importance of high-volume, task-specific practice to acquisition of motor skills. Another may be to explore with families practical ways so that they can provide opportunities for children with motor delay or dysfunction to obtain this type of practice on a routine basis within the context of a busy family life.

Importance of meaningful goals

One of the ways in which the environment may exert its influence, in the context of dynamic systems theory, is through the affordance of opportunities to obtain the type and frequency of activity needed to create these neuronal synergies. Legenstein, Pecevski and Maass (2008) found that the timing and sequencing of neuronal firing patterns and the structure of the gap between neurons or synapse changed when task performance was rewarding for the individual. These findings were also seen in the behaviors of children with CP following a 3-week group intervention in which children participated in 3 hours of goal-directed, activity-focused therapy. Sorsdahl et al. found that children’s scores on the 66-item Gross Motor Functional Measure and on the Pediatric Evaluation of Disability Inventory self-care functional skills, self-care caregiver assistance, and mobility caregiver assistance scales were significantly improved after the 3-week period compared with measurements taken during the baseline period. This approach to intervention is consistent with dynamic systems theory and may serve as a model that can be adapted for EI. It also highlights the importance of taking the time to work with families and children to develop goals and service plans that will be meaningful enough to drive the process of neuronal selection through activity.

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influence intervention outcomes (Bartlett & Palisano, 2000). Specifically, professionals must go beyond understanding the family context and health resources available by helping to improve the family’s capacity for addressing their child’s needs, connecting them with resources, and advocating for access to services when necessary, the foundational tenets of part C services.

The World Health Organization (WHO) has taken even broader perspective in creating the International Classification of Functioning, Health, and Disability (ICF; WHO, 2001) and its companion the ICF for Children and Youth (ICF-CY; WHO, 2005). The ICF and ICF-CY were designed to provide a common language through which professionals from different backgrounds and cultures might work to optimize outcomes for individuals with specific health conditions (Jette, 2006). These models examine the effects of an individual’s health condition on body structure and function within body systems, activities involving the whole person, participation or the ability to be fully engaged in life as a member of a family, community, school, or work. For example, a child with spina bifida is likely to experience some impairment of body structure and function, such as weakness or paralysis, but may be able to have independent locomotion with bracing or a wheelchair that would allow them to assume all the roles in family or community in which children without spina bifida might participate. The process through which the consequences of health conditions exert their influence is known as enablement.

Like the model for determinants of change, ICF models of enablement also recognize the significant contributions of personal characteristics and environmental contexts on all levels from body structure and function through disability (WHO, 2005). First-generation EI approaches focused almost exclusively on interventions designed to change the child’s impairments of body structure and function. As a result, researchers found small improvements in impairments of body structure and function but no significant changes in activity limitations or participation restrictions. If EI providers want to improve outcomes at the level of activity, they must assess the child’s functional mobility skills and design interventions that allow for high-volume, task-specific practice of those activities. Similarly, if EI providers hope to improve outcomes related to the child’s participation within family or play situations, they must incorporate strategies that allow families to recognize and capitalize on opportunities for practice. This is important because addressing these levels may empower parents to become more collaborative in setting goals for their children. Randall and McEwen (2000) report that individuals seeking the help of a physical therapist rarely express their goals in terms of impairments of body structure and function. That is, parents are unlikely to approach the process of developing an individualized family service plan by setting a goal for their child to improve antigravity postural control and may withdraw from the process if such a suggestion is made. Parents are more likely to express goals at the level of activity or participation, such as wanting their child to walk or being able to take their child camping with the rest of the family. Designing goals and interventions that take into account personal and environmental factors may increase the likelihood of improving outcomes for children with motor delay or dysfunction and build the capacity of families to meet the needs of their children.

**A COHESIVE CONTEMPORARY PRACTICE MODEL**

First-generation approaches to EI for young children with motor delay or dysfunction are characterized by child-centered, developmental interventions that are not well supported by empirical evidence. Investigators have identified numerous reasons for the lack of evidence supporting first-generation approaches to intervention in young children with motor delay or dysfunction, including a narrow focus on motor outcomes at the level of body structure and function, the severity
of disability in this population, poor sensitivity of tools used to measure progress, and the ethical inability to withhold treatment from young children (Harris, 1997). While this approach is still evident in EI services, neither the science of early-childhood development nor research-based evidence supports continued use of approaches aimed at improving motor outcomes by progressing through prescribed developmental sequences in isolated environments.

Recently, Riethmuller, Jones, and Okely (2009) conducted a systematic review of interventions designed to improve motor development in children less than 5 years of age. This team reviewed 17 studies involving a variety of approaches to intervention, many of which were somewhat vaguely defined, making it difficult to determine whether they followed second-generation family-centered, supported-based principles. They found that while 71% of the reviewed studies reported improvements in motor skills in intervention groups, only 2 studies reported statistically significant differences between children who received intervention and those who did not. While this review appears to suggest that second-generation interventions may be no more effective than the strategies they replaced, a closer examination of the studies examined in this systematic review include poorly defined interventions such as “perceptual motor development activities” and “motor skill intervention” that may be more consistent with first-generation approaches than with the ideals of family-centered support-based services (Riethmuller et al., 2009). This reinforces the idea that the complexity of implementing in everyday practice has proven challenging.

Recommendations of Riethmuller et al. for improving EI service provision and child outcomes emphasized partnering with parents and caregivers, considering skills and training of personnel delivering interventions and supporting treatments with sound theoretical frameworks. These recommendations are consistent with those espoused by advocates of family-centered support-based approaches, including Bruder, Dunst, McWilliam, and others, and with the tenets of dynamic systems theories.

We have presented a model that integrates a perspective of early-childhood science solidly grounded in the principles of family-centered, support-based care and contemporary systems theory (Figure 2). We have also presented empirical evidence regarding specific strategies that appear to be consistent with this model, effective, and

Figure 2. Proposed relationships among basic science, theory, enablement model, and practice.
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reasonable to implement in EI practice settings. To close the gap between what providers know and what they do, interventionists must partner with families to meet the following requirements:

1. Develop meaningful goals with measurable outcomes that span all levels of the ICF;
2. Find ways to build opportunities for children to engage in high-volume, task-specific practice of target behaviors;
3. Design intervention strategies in which children are engaged in goal-directed tasks in the natural environment; and
4. Invest time in communication and advocacy to build the capacity of the child’s family and EI team to meet their child’s needs.

Finally, this article has focused primarily on research-based evidence for recommendations regarding EI programming for children with motor delay or dysfunction. It is important to remember that this evidence comprises only 1 of 3 components of evidence-based practice. Early intervention service providers, like other education and healthcare professionals, must consider all 3 components of evidence-based practice to be important: the best available research evidence, child and family preferences, and their own clinical judgment (Straus et al., 2005).

DIRECTIONS FOR FUTURE RESEARCH

Although we acknowledge the complexity of the environments in which children grow and develop, we believe that additional research is necessary to identify those factors in the child’s environments that afford the amount and type of activity necessary to achieve independent mobility, with a particular focus on elements that may be amenable to change by early interventionists’ providing services. Such research would help to bridge the gaps between science, theory, and practice by identifying the types of family supports that may benefit many young children with motor delay. We also encourage continued exploration of the adaptation of a practice-based evidence approach in which investigators precisely examine the types of motor interventions being provided by EI and the outcomes associated with them (Hashimoto & McCoy, 2009). Such investigations will contribute greatly to the confidence with which EI providers can engage in evidence-based EI service planning. Until then, we must do our best to consider the evidence in the context of child and family preferences and open our minds to new findings and frameworks, so that the actual services provided by early interventionists more closely approximate the evidence we are trying to incorporate into practice.

REFERENCES


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