



# Supporting Children with Severe Disabilities to Achieve Means-End

Susan Bruce  
Cailen Campbell  
Meghan Sullivan

---

*A Feature Article Published in*

*TEACHING Exceptional Children Plus*

*Volume 6, Issue 1, 2009*

---

*Copyright © 2009 by the author. This work is licensed to the public under the Creative Commons Attribution License*



# Supporting Children with Severe Disabilities to Achieve Means-End

Susan Bruce  
Cailen Campbell  
Meghan Sullivan

---

## Abstract

Means-end behavior occurs when the child can carry out a sequence of steps, including the removal of a physical obstacle, to achieve a goal. The development of means-end knowledge occurs in three stages: transitional, intentional, and comprehensive. Comprehensive means-end is achieved when the child can generate solutions without demonstration of the solution by another and without trial and error. The achievement of means-end is considered a pivotal developmental milestone because of its strong positive correlation to intentional communication and its relationship to understanding the intent of other's actions. It is important to create accessible opportunities for children with disabilities to observe others solving means-end problems. High interest and personalized materials that are age appropriate will motivate children to solve means-end problems. This article presents a review of research on means-end development in children with severe disabilities, information on how to assess and teach means-end, and two case studies (with lessons and video) to illustrate key concepts.

---

## Keywords

Means-end, severe disabilities, video case studies

## SUGGESTED CITATION:

Bruce, S., Campbell, C. & Sullivan, M. (2009). Supporting Children with Severe Disabilities to Achieve Means-End. *TEACHING Exceptional Children Plus*, 6(1) Article 2. Retrieved [date] from <http://escholarship.bc.edu/education/tecplus/vol6/iss1/art2>

Means-end behavior is “the deliberate and planful execution of a sequence of steps to achieve a goal and it occurs in situations where an obstacle preventing achievement of the goal must initially be removed (Willatts, 1999, p. 651).” Means-end behavior is intentional behavior; there is an obvious goal and the child persists to achieve that goal. The child who has achieved comprehensive means-end understanding knows that the effect an action has on an object will be the same on another object and that the effect an action has on an object in one location will be the same in another location. Means-end behavior includes achieving a sub-goal (the removal of the obstacle) while keeping in mind and accomplishing a larger goal. This distinguishes it from simple cause-effect behaviors.

**Means-end behavior is intentional behavior; there is an obvious goal and the child persists to achieve that goal.**

Means-end is regarded as a pivotal cognitive milestone because it has a strong positive correlation to the onset of nonverbal and verbal intentional communication (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bates, Bates, Carlson-Luden, & Bretherton, 1980). In addition, comprehensive means-end understanding is critical to identifying the purposes or goals of actions, predicting future actions, and for organizing sequences of actions (Sommerville & Woodward, 2005).

This article will describe the sequence of means-end development within a Piagetian framework. Although there have been challenges to Piaget’s claims about when means-end is mastered, his proposed developmental sequence for means-end is largely agreed

upon. Research on means-end development in children with severe disabilities will be discussed followed by sections on assessing and teaching means-end behaviors within the context of age appropriate activities. Two case studies will be used to illustrate assessment and teaching principles.

### **Piagetian Perspective on Means-End**

Piaget described how means-end behaviors develop out of earlier cause-effect behaviors during the Sensorimotor Period. Intentional behavior precedes true means-end behavior. While children with intentional behavior repeat bodily actions to gain a specific effect, they are not yet capable of tool use. They recognize that they can create effects on objects, but they do not yet realize that others can do the same without their influence. During this transitional stage of means-end development, they may accidentally produce solutions to problems but they are confused by goal-sub-goal conflicts. For example, if presented with a highly desirable toy attached to a cloth, they become distracted from setting a goal to acquire the toy and instead play with the attached cloth (Willatts, 1999). The transitional stage is followed by an intentional means-end stage characterized by a growing understanding that other people can create effects on objects and that they may use tools to create effects on objects. This understanding is essential to the development of more advanced means-end behaviors, but at this phase of development understanding of means-end relationships is still very much bound by personal experiences and observations of others solving means-end problems. Gradually children break out of personal context boundaries and exhibit means-end behavior using novel objects although in its earliest

form this ability is generally manifested through trial and error (Wadsworth, 1996). Finally, in the comprehensive stage of means-end achievement children can predict the necessary means to create a particular effect or end allowing them to generate solutions for new problems without trial and error (Kopp, O'Connor, & Finger, 1975). Problem solving is no longer so tightly connected to observation or experience and it involves multiple steps. Children in the comprehensive stage also are able to understand the intent of another's actions and to then alter the means to achieve the same end (Sommerville & Woodward, 2005).

### **Means-End Development in Children with Disabilities**

While the majority of means-end research on children without disabilities focuses directly on the developmental sequence and the age at which means-end behaviors are achieved, most of the research on children with severe disabilities emphasizes how the development of means-end is connected to intentional communication and language development. Although means-end development is often delayed in children with severe disabilities, the sequence of achievement is the same as children without disabilities. See "Gray Box 1: Research on Means-End Development in Children with Disabilities" for more details on these studies.

### **Assessing Means-End Behavior**

Means-end behaviors can be assessed using formal assessment tools (with norming data), informal commercial tools (without norming data), or through structured informal assessment. Some of the commercial assessments provide companion instructional materials.

**Assessment of young children is often done in the context of play but adults can create opportunities for children of any age to display means-end skills.**

As cited in the research discussion, the scales by Uzgiris & Hunt have been popular for use in research studies for three decades. The Uzgiris and Hunt Scales of Infant Psychological Development (1980) features 19 items that measure true means-end behaviors and an additional 6 items that measure closely related precursor skills. The Hawaii Early Learning Profile (HELP), HELP Strands 0-3 (Parks, 1996) includes 13 items that measure means-end behavior on page 5. The Carolina Curriculum for Infants/Toddlers with Special Needs (Johnson-Martin, Attermeier, & Hacker, 2004) features 6 items to measure means-end behavior (items 8n, 8o, 8q, 8r, 8u, 8v, and 8y). Both the HELP and the Carolina are curriculum-based assessments that provide instructional ideas appropriate for young children.

### **Gray Box 1: Research on Means-End Development in Children with Disabilities**

Hupp, Able, and Conroy-Gunter (1984) assessed object permanence, means-end relations, operational causality, and gestural imitation in 25 children and young adults (5-19 years) with severe intellectual disability using the Assessment in Infancy: Ordinal Scales of Psychological Development (Uzgiris & Hunt, 1975). They found that the level of performance on object permanence tasks always equaled or exceeded performance on means-end relations. Means-end task performance was always equal to or better than performance of gestural imitation, which was equal or better than performance of operational causality tasks. Although there is some overlap in achievement, this study suggests a developmental sequence, for children with severe disabilities, of cause-effect followed by gestural imitation, means-end, and object permanence. Although the developmental sequence of these four skills is similar in children without disabilities, children with severe disabilities tend to perform relatively well (when comparing their mental age at achievement with the chronological age at achievement in children without disabilities) on sensorimotor tasks that have low social demands, such as object permanence and means-end (Hupp, et al).

The relationship between sensorimotor achievements and communication development was examined by Mundy, Seibert, and Hogan (1984). They divided their 54 child participants with developmental delays into three groups by mental age (2-7 months, 8-13 months, and 14-21 months) as determined by the Bayley Infant Mental Scale (Bayley, 1969). Sensorimotor behaviors were assessed using the Assessment in Infancy: Ordinal Scales of Psychological Development (Uzgiris & Hunt, 1975) and communication was assessed using the Early Social-Communication Scales (Seibert & Hogan, 1982). They found a strong positive correlation between the performance of means-end skills and object play abilities with the performance of early communication skills in children in the eight to thirteen month mental age group.

Abrahamsen and Mitchell (1990) conducted a study that was similar to Mundy et al's except that the participants were children with autism, with nine of the ten children having achieved intentional nonverbal or verbal communication. They also used the Assessment in Infancy: Ordinal Scales of Psychological Development (Uzgiris & Hunt, 1975) to assess select sensorimotor behaviors. They determined communication performance by using a two-hour communication sample that was taken in the context of routine school activities with care taken to not count non-communicative echolalia. They found that level of communication correlated strongly with means-end achievement and that all of the children with intentional verbal communication demonstrated comprehensive means-end performance.

The relationship between means-end behavior and communication was also studied by Woodyatt and Ozanne (1992). They studied six girls with Rett syndrome (ages 2 years, 6 months to 13 years, 7 months) who were pre-intentional in their communication (perlocutionary) and found that they did not yet exhibit means-end behaviors. Three years later they did a follow up study on the girls and although they were still pre-intentional in their communication there were small gains in both communication and early means-end behaviors (Woodyatt & Ozanne, 1993). They concluded that there is a relationship, although not necessarily causal or unidirectional, between means-end development and non-verbal communicative interaction.

Assessment of young children is often done in the context of play but adults can create opportunities for children of any age to display means-end skills. The following structured informal assessment is based on a review of the literature and is organized developmentally but it can be used with older students when the tasks to elicit the behaviors are age appropriate. Note that Question #1 is a transitional means-end behavior. The remaining questions measure intentional means-end behaviors (performing by trial and error or based on observation) and comprehensive means-end behaviors (applying solutions to new problems using novel objects without demonstration or trial and error). (See *Structured Informal Assessment of Means-End* on following page.)

### **Teaching Means-End Behavior**

Teachers and parents can create opportunities for children to observe and rehearse means-end solutions for a variety of tasks. Castle (1985) suggested the following five means-end task classifications: (1) using objects as tools in self-help activities (such as hanging up clothing), (2) using objects as tools in dramatic play (such as using plastic pipes and spouts during pretend play about plumbing), (3) using objects as tools to create interesting effects (such as using different types of containers to create science and art projects), (4) using objects as tools to move other objects (such as combining boxes and a pull or push cart to complete a task), and (5) using objects as tools to reach other objects (such as pulling a string to access a hidden toy or using a spoon to access something in a tall container). These tasks can easily be adapted to be age appropriate and functional for older children

Although there is very little literature on how to teach means-end behaviors to chil-

dren with disabilities, Gray Box 2 describes these few studies.

### **Case Studies on Teaching Means-End**

The following case studies are presented to illustrate connections between the assessment and instruction of means-end in two children with severe disabilities. Each child's means-end knowledge was assessed using two commercial assessment tools and the structured informal assessment presented earlier. A transdisciplinary team approach to systematic instruction was used to teach key developmental milestones associated with symbolic expression and representational thought, including means-end. Each team reached consensus on the assessment results and on the lesson plan that provided the minimal structure for the lesson. Team members were free to add additional comments and alter prompting according to daily conditions. Each lesson was instructed five times weekly, three times by the classroom staff, and once each by two related service professionals. Daily data was collected as well as baseline and monthly video evidence. The assessment results, abbreviated lesson plans, and results of instruction are presented for each case.

### Structured Informal Assessment of Means-End

1. If an object is out of reach, will the child persist in efforts to obtain it?
2. If there is an obstacle to getting access to an object, will the child remove it? (Examples: pushes obstacle out of the way, reaches over it, removes cloth that is over or under desired object?).
3. If a favorite toy is attached to a string, will the child pull the string to get to the toy? Horizontally? Vertically?
4. Will the child turn a container over to get objects that are inside to empty out?
5. Does the child use another person to achieve a goal (using adult's hand to access something of interest)?
6. Does the child hand adults a toy when it is not working correctly or when child wants it restarted ?
7. Does the child use one object to obtain another (such as using a stick to move a preferred object within reach)?
8. If a desired object is placed inside a box with a lid, will the child remove the lid to access the object?
9. Does the child turn doorknobs or activate other types of devices to access something? Please give examples.
10. Does the child activate toys/objects independently after an adult has demonstrated how to do it? (This is also imitative.)
11. Does the child perform only means-end behaviors that have been first demonstrated?
12. Does the child primarily use trial and error to solve mean-end problems?
13. Does the child activate toys/objects without demonstration first?
14. Does the child perform other means-end behaviors without demonstration? (If so, please list.)
15. Will the child locate a container to hold multiple objects instead of moving them to a new location separately (without demonstration)?
16. Will the child locate and then stand on a box, chair, etc. to access something out of reach (without demonstration?)
17. Does the child identify the intended "end" in another person's means-end sequence and then achieve the same end through a different means?

Please record examples of means-end behaviors that you've observed the child perform.

(Bruce, 2007).



## Gray Box 2: Research on Teaching Means-End to Children with Disabilities

Although there is very little literature on how to teach means-end behaviors to children with disabilities, an experiment on typically developing children by Provasi, Dubon, and Bloch (2001) provides important insights. In their experiment 40 young children were assigned to one of two groups, an experimental group that was provided with opportunities to observe means-end performance in others and a control group that learned to perform means-end tasks through their own actions (e.g. no observational component). While group assignment did not make a difference in children with a mental age of 9 months, children who were at the mental age of 12 months and assigned to the observational group were able to perform means-end at a higher level and more rapidly than those who did not have the observational opportunities. Bates, Carlson-Luden, & Bretherton (1980) also found that visual attention facilitated the development of means-end. So, although providing opportunities for children to solve problems on their own is important, they must also have opportunities to observe others and when vision is impaired, it is important to provide access through auditory and tactile channels.

Mechling (2006) taught three children with severe disabilities to solve cause-effect and means-end problems. The study tasks included (a) activating switches to create various effects on toys and other objects (such as fans, bells, and flashing lights), (b) activating switches to interact with commercial software activities, and (c) personalized video. The videos (c) were of the child participants engaging in preferred activities with preferred people. These videos were then inserted within power point presentations to provide children with obstacles to overcome. Mechling found that (c) the individualized videos were more likely than either the switch activated activities or the software activities to elicit activation by the students. She concluded that children with severe disabilities must be provided with tasks of high interest in order to elicit means-end behaviors. The three students in this study were motivated by the personalized nature of the videos.

### Case Study #1

Case Study #1 is on “Nikhil”, who was 4 years, 11 months at the time of assessment. Nikhil has microcephaly, global developmental delays, and autism. At the time of assessment, Nikhil exhibited frequent mouthing of all objects and he often moved objects back and forth repetitively. Assessment indicated that he could move around obstacles, that he pushed other objects away to get to a desired object, and that he inverted containers to get objects out. These are examples of early means-end behaviors. A toy called, Press and Go Emergency Garage, was pur-

chased at Lakeshore®. This toy was selected because it offered Nikhil opportunities to rehearse relatively simple means-end tasks but also offered opportunities for him to learn multiple steps to achieve more advanced means-end tasks. It also was selected because of Nikhil’s interest in vehicles. The garage toy consisted of three garage doors of different colors with color coordinated cars and drivers. The garage doors could also be locked (by using the color coordinated driver) to create a more complex type of problem to solve. The team decided to use backward chaining to teach Nikhil to use this toy. Nikhil’s first lesson on the color garage in-



volved requiring him to simply push down the driver, referred to as “red man,” (which the adult placed on top of the garage) to expel the red car. The other two garage doors were locked. (The adult had already opened the red door.) Since he was already able to use simple switches, he achieved this goal within the first month when provided with modeling prompts. The following video clip illustrates this lesson.

### **Please Click**

***Nikhil: Means-End Lesson #1 Month 1”***

**in Associated Files on this article’s site to download video. After downloading, the video will open in a new window.**

The team decided that because Nikhil could perform Lesson #1 with just modeling, he was ready for the addition of a new step in the instructional sequence, so the backward chain was extended. Lesson #2 follows and is also illustrated in the video clip to follow:

1. Adult places red man on tabletop. (Red garage door is open and other doors are locked.)
2. Nikhil will pick up the red man.
3. Nikhil will place red man on top of the garage.
4. Nikhil will push red man to expel car.
5. Adult will praise: “Nikhil, good. You got the car out.”

Prompt/performance levels were: no response (NR), refusal (R), hand-over-hand (H/H), physical prompt (PP) (such as a touch to the hand or elbow), modeling (M), gestural prompt (G), verbal prompt (V), or independent (I).

### **Please Click**

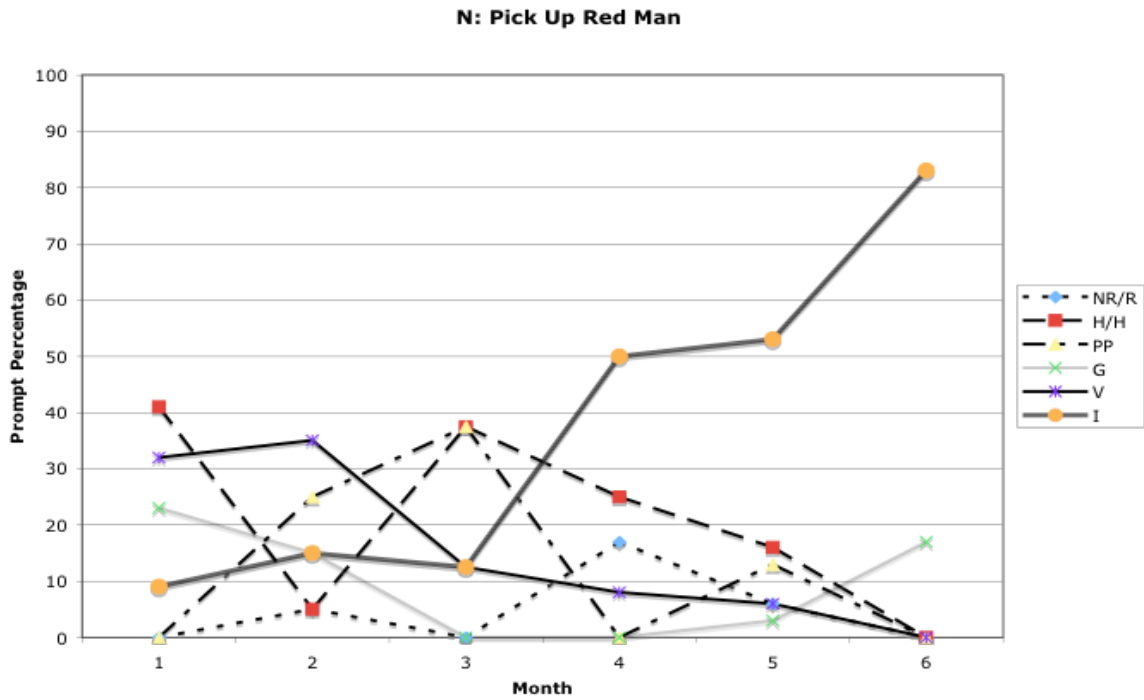
***Nikhil: Means-End Lesson #2 Month 3”***

**in Associated Files on this article’s site to download video. After downloading, the video will open in a new window.**

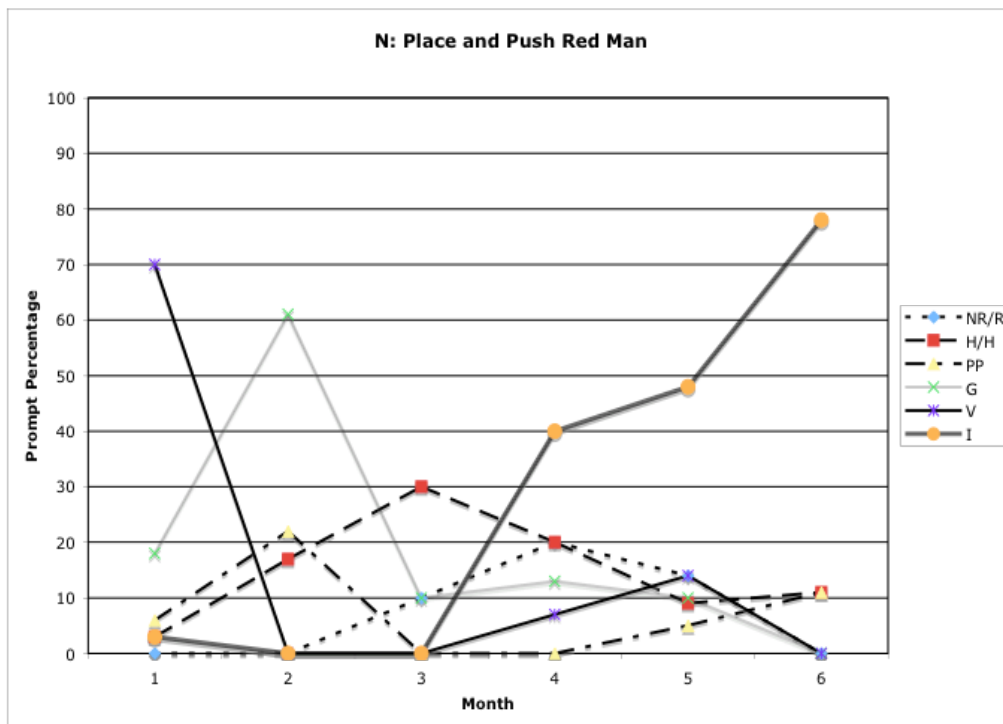
Data was taken on two behaviors in Lesson #2: (1) pick up “red man” and (2) place/push red man to expel car. Although Steps 3 and 4 were separate on the lesson plan, they became merged on the data sheets because Nikhil never placed the red man without expelling the car because he merged the movements of place and push. In cases when staff used more than one prompt in combination (which most often occurred when gestural prompts were combined with verbal), both types of prompts were counted.

Nikhil’s performance of Behavior #1 (pick up red man) improved from 9% independence in the first month of instruction to 83% in the sixth month. Figure 1 depicts the levels of prompts required. Note that no response and refusal were merged into one line to restrict the number of lines depicted. In addition to graph data, modeling was used at the 3% level in the month of November only. Nikhil’s performance on Behavior #2 (place and push red man) improved from 3% independence in the first month (due to the additional demand to place in on top of the garage) to 78% independence in the 6<sup>th</sup> month. Please see Figure 2. While the types and levels of needed prompts varied somewhat across the different staff, verbal prompts were reduced as Nikhil gained independence. Nikhil guided the staff to the next skill to add

**Figure 1: Level of Prompts Required**



**Figure 2: Nikhail's performance on "place and Push Red Man"**



to the backward chain when he demonstrated anticipation of the routine by reaching toward the garage to lift up the garage door. One rule that may have supported his achievement is that Nikhil was only allowed to play with the garage in the contexts of the 1:1 instructional sessions. The toy was first introduced at baseline and he was not allowed to use this toy in the context of free play. This instructional decision was made by the team in an effort to limit the stereotypy he performed on the toy. It may have made guidance about how to interact with the toy more tolerable (because he had not already established a habit of engaging in stereotypy with the toy). Although we were not measuring interfering behaviors, daily observation notes and videos provided evidence that Nikhil's interfering behaviors (such as mouthing the car or self stimulation with the car) became less frequent over the course of the study.

## Case Study #2

Case Study #2 is on "Jimmy" who was 10 years, 11 months at the time of assessment. Jimmy is non-ambulatory with global developmental delays, hydrocephalus, and difficulties in maintaining his body temperature (which affects his well-being and his performance). At the time of assessment, Jimmy displayed a purposeful reach and was willing to work to access objects of interest that were out of reach. He did not request assistance from an adult at the time of assessment. Jimmy's teacher wanted him to be able to engage in a leisure activity that many boys his age enjoy, remote control vehicles. A standard remote control and car were purchased at Radio Shack ®. Since Jimmy is a wheelchair user, some adaptations were made so that he could view the movement of the car, which was also necessary to achievement of the

means-end behaviors. His therapists created a platform with an edge that was placed on a table. In this way, he could see when the car "crashed" and also associate this visual image with the sound of the "crash" and the need to push the control in a specific direction. The therapists also stabilized the remote control by mounting it. His lesson plan follows

1. Position Jimmy in front of platform (that is placed on a table) with the car on top of platform.
2. Say, "Jimmy," let's make the car crash."
3. If another prompt is needed, say, "Jimmy, push up" or "Jimmy, push down."
4. When the car crashes, say "Crash!"

Prompt/performance levels were: hand over hand (H/H), physical prompt (PP), gesture (G), sign (S), verbal (V) and independent (I) although sign (S) was only used to elicit the first behavior, reach toward the remote control.

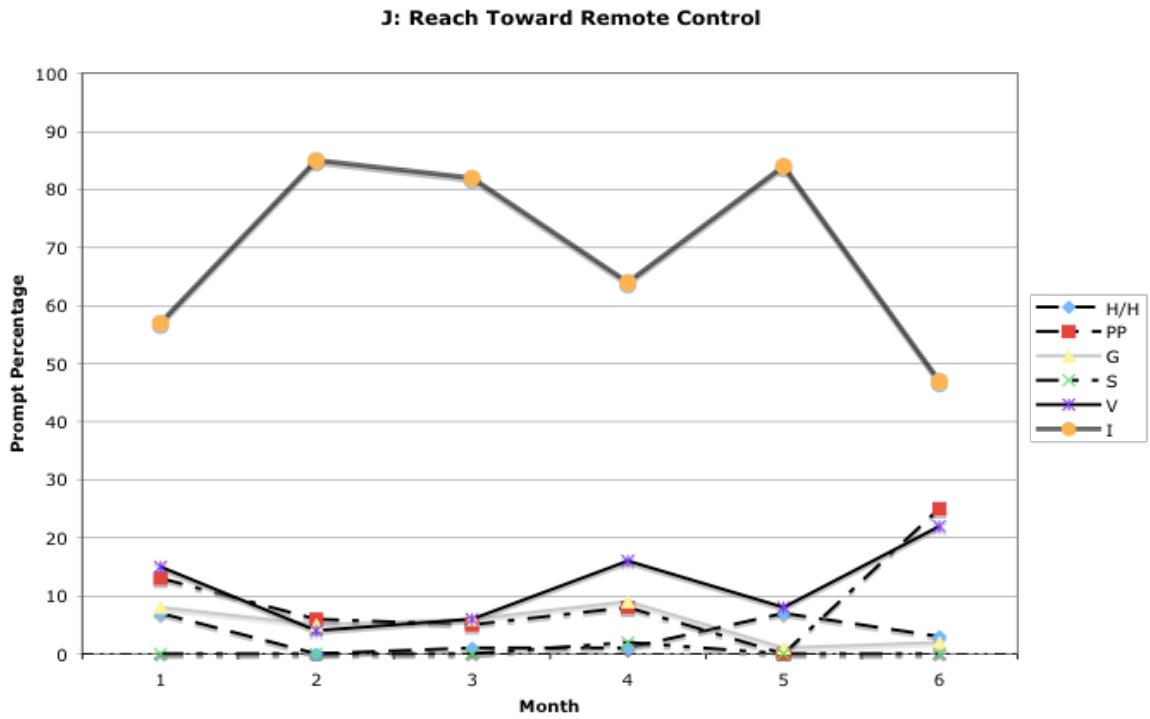
### Please Click

***"Jimmy: Means-End Month 2"***

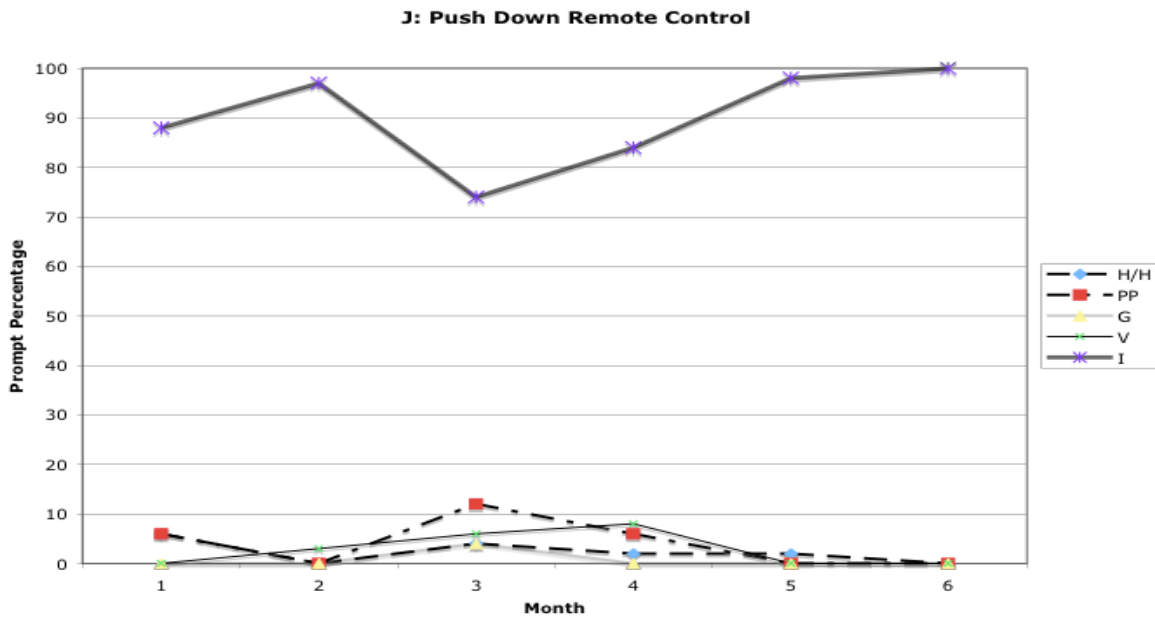
**in Associated Files on this article's site to download video. After downloading, the video will open in a new window.**

Data was collected on three behaviors within the instructional sequence (1) reach toward the remote control, (2) push down on the remote control, and (3) push up on the remote control. Figures 3, 4, & 5 depict Jimmy's performance over the six-month instructional period on each of the three behaviors. As Figure 3 depicts, Jimmy's performance of the first behavior (reaching toward the remote control) varied. He achieved beyond

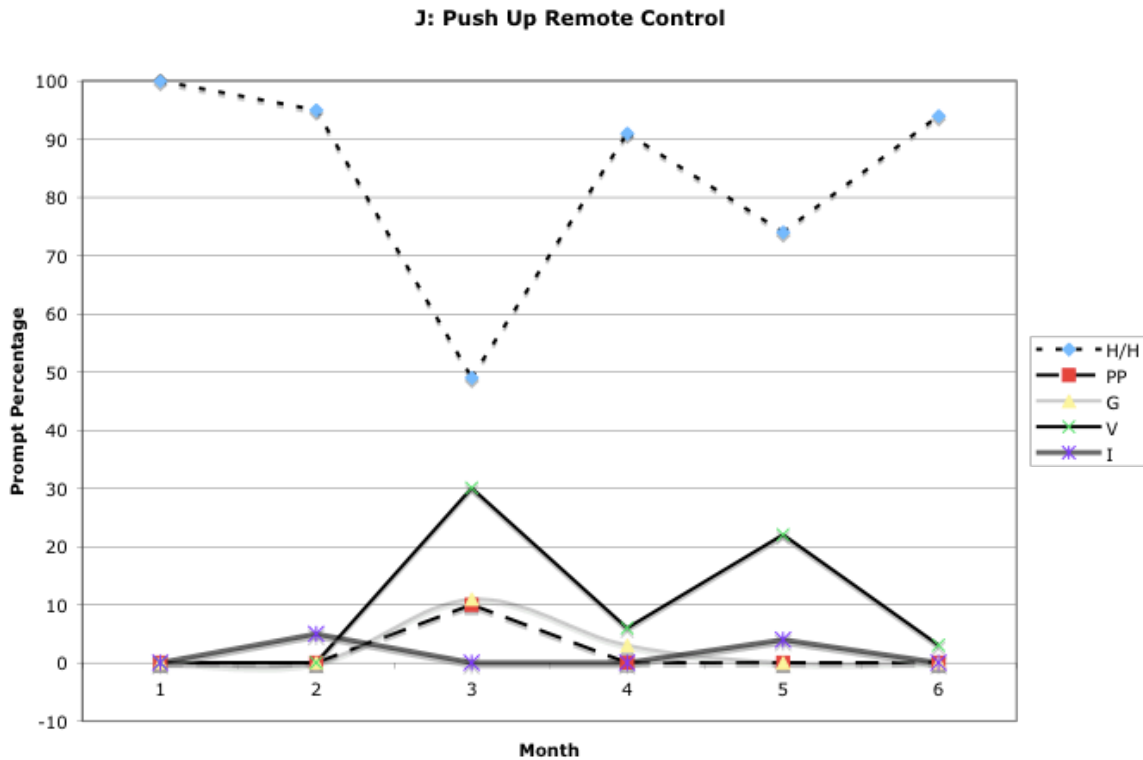
**Figure 3: Jimmy’s Performance on “Reach toward remote control.”**



**Figure 4: Jimmy’s Performance on “Push down remote control.”**



**Figure 5: Jimmy’s Performance on “Push up remote control”**



80% independence three of the last five months, but showed a decline in independent performance in the last month. The decline in the fourth month may have been caused by a prolonged summer break that resulted in a 6 week break from instruction. Jimmy was very successful at pushing the remote control down (the second behavior). His independent performance was never below 70% and for five of the six months he achieved this behavior above the 80% level. Videos and data indicate that J could independently hit the switch to the down position but struggled to push it up. This was motorically more difficult for him but within his physical abilities. Although he demonstrated 5% independence in the second month and 4% in the fifth month, it required a great deal of effort from Jimmy to perform this skill.

While Jimmy did not achieve independence on pushing up, his performance showed some emerging ability to perform the skill and he developed the ability to request assistance from staff for pushing up on the switch although initially his requests almost always followed trial and error efforts. Jimmy first initiated reaching to the adult to get assistance for support for the third behavior, push up on remote control, in the fourth month of instruction. This achievement is masked in the data graphs because it was coded as a physical prompt, but data notations from the team and monthly video evidence clarify when he initiated requests for physical support. Although his solution to the problem (of pushing up on the remote control) was different than what the team had intended, he achieved means-end performance on this step

at the trial and error level because he used an adult as a tool after making attempts to activate the control on his own. The ability to request support from adults by reaching out, taking the adult's hand, and then guiding the adult's hand toward the problem or obstacle is an important achievement for Jimmy.

This case study illustrates that means-end behaviors can be taught to an older child in the context of an age appropriate and highly motivating activity. One of the outcomes of his performance on this lesson was a trial period for assessment using an electric wheelchair with a joystick.

### **Conclusion**

The achievement of means-end is considered a pivotal developmental milestone because of its strong positive correlation to intentional communication and its importance to identifying the goals of others. Means-end mastery occurs in three stages: transitional, intentional, and comprehensive. Comprehensive means-end is achieved when the child can generate solutions without demonstration of the solution by another and without trial and error. Although there is very little literature about teaching means-end behaviors to children with disabilities, high interest and personalized materials that are age appropriate will motivate children to solve means-end problems. In addition, it is important to create accessible opportunities for children with disabilities to observe others solving means-end problems. This may include observing trial and error procedures used by others. Assessment can guide teachers and parents to create opportunities for children with disabilities to master means-end behavior at a level that is individually appropriate.

### **References**

- Abrahamsen, E. P., & Mitchell, J. R. (1990). Communication and sensorimotor functioning in children with autism. *Journal of Autism and Developmental Disorders*, 20, 75-85.
- Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols: cognition and communication in infancy*. New York: Academic Press.
- Bates, E., Carlson-Luden, V., & Bretherton, I. (1980). Perceptual aspects of tool use in infancy. *Infant Behavior and Development*, 34, 127-140.
- Bayley, N. (1969). *Manual for the Bayley Scales of Infant Development*. New York: Psychological Corporation.
- Bruce, S. (2008). *Informal Assessment of Means-End*. Chestnut Hill, MA.
- Castle, K. (1985). Toddlers and tools. *Childhood Education*, 61, 352-355.
- Hupp, S. C., Able, H. & Conroy-Gunter, M. (1984). Assessment of sensorimotor abilities of severely retarded children and adolescents. *Diagnostique*, 9, 208-217.
- Johnson-Martin, N. M., Attermeier, S. M., & Hacker, B. J. (2004). *The Carolina Curriculum for Infants & Toddlers with Special Needs*. Third Edition. Baltimore: Paul H. Brookes Publishing Co.
- Kopp, C. B., & O'Connor M. J. (1975). Task characteristics and a stage 6 sensorimotor problem. *Child Development*, 46, 569-573.

Mechling, L. C. (2006). Comparison of the effects of three approaches on the frequency of stimulus activations, via a single switch, by students with profound intellectual disabilities. *The Journal of Special Education*, 40, 94-102.

Mundy, P., Seibert, J. M., & Hogan, A. E. Relationship between sensorimotor and early communication abilities in developmentally delayed children. *Merrill-Palmer Quarterly*, 30, 33-48.

Parks, S. (1996). HELP Strands, Curriculum-Based Developmental Assessment. Birth to Three Years. Adapted from the Hawaii Early Learning Profile. Pala Alto, CA: Vort Corporation.

Provasi, J., Dubon, C. D., Bloch, H. (2001). Do 9- and 12-month-olds learn means-end relation by observing? *Infant Behavior & Development*, 24, 195-213.

Seibert, J. M., & Hogan, A. E. (1982). Procedures manual for the Early Social-Communication Scales. Unpublished Manuscript, Mailman Center for Child Development, University of Miami, FL.

Sommerville, J. A. & Woodward, A. L. (2005). Pulling out the intentional structure of action: the relation between action processing

and action production in infancy. *Cognition*, 95, 1-30.

Uzgiris, I. C., & Hunt, J. M. (1975). Assessment in infancy: Ordinal scales of psychological development. Urbana, IL: University of Illinois Press.

Wadsworth, B. (1996). Sensorimotor development. In, Piaget's Theory of Cognitive and Affective Development, (pp. 33-56). New York: Longman.

Willatts, P. (1999). Development of means-end behavior in young infants: pulling a support to retrieve a distant object. *Developmental Psychology*, 35, 651-667.

Woodyatt, G., & Ozanne, A. (1992). Communication abilities and Rett syndrome. *Journal of Autism and Developmental Disorders*, 22, 155-173.

Woodyatt, G. C., & Ozanne, A. E. (1993). A longitudinal study of cognitive skills and communication behavior in children with Rett syndrome. *Journal of Intellectual Disability Research*, 37, 419-435.

***About the authors:***

**Susan Bruce** is Associate Professor and Coordinator of the Severe Special Needs Program in the Lynch School of Education at Boston College.

**Cailen Campbell** is a graduate of the Severe Special Needs Program at Boston College and teaches students with severe disabilities in the Boston area.

**Meghan Sullivan** is a graduate of the Severe Special Needs Program at Boston College and teaches students with severe disabilities in the Boston area.