

# Case study of the Identification, Assessment and Early Intervention of Executive Function Deficits

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## Abstract

*Educators recognize the need to identify young children who may require intervention because the sooner intervention is initiated, the greater the possibility for remediating a problem. It is imperative that teachers be provided with timely and sufficient information about their students in order to begin to help child become successful learners. Executive functions play a fundamental role in a child's cognitive and social-emotional/behavioral functioning; hence the importance of early detection and early intervention. Through early screening, assessment and intervention, there is greater potential to enhance a child's long-term achievement, functional independence, and social-emotional/behavior challenges. This article focuses on the identification, assessment, and intervention of execution function deficits through a case study.*

*Key words: Early intervention, identification, assessment, young children, case study.*

Fundamental to special education in the U.S. is the belief to a free appropriate public education (FAPE) where each child has the right to a comprehensive, multifactored evaluation and intervention based on the assessment results (Smith, 2007). Data from the multifactored evaluation helps identify the child's strengths and needs and to assure that the child receives special education and related services provided through an individualized education program (IEP), and that allow the child to be involved in and

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make progress in the general curriculum. Consequently, educators need to identify early on young children who may require early assessment and intervention. The sooner the child's needs are identified and intervention is initiated, the greater the possibility for remediating a child's long-term achievement, functional independence, and social-emotional/behaviors (Elliott, Huai, & Roach, 2007). Thus, educators need to identify academic problems, gather information specific to the stated problem and design and implement interventions for young children.

The following case study illustrates the need for early detection and intervention to enhance the learning opportunities for a young child in the U.S. This vignette specifically identifies the problems of a child with executive functioning deficits and the collaborative effort needed for effective assessment and intervention:

*Brian is five years, ten months old and is enrolled in kindergarten an elementary school in the Midwestern United States. His kindergarten teacher has observed that Brian is not demonstrating the skills typical and expected of a child of his age level. She states that he does not sustain attention long enough to complete his work without constant redirection. He displays distractibility, hyperactivity, impulsivity, difficulty transitioning, disorganization, and poor work habits (careless, sloppy, procrastinates). Brian also has difficulty sitting still to complete his work, often runs around the classroom when he should be walking, "blurts out answers", and is often unable to follow a one-step direction or complete a short activity without her assistance. After waiting to make sure Brian is not experiencing problems with adjusting to school, the teacher requests the support of the school-based intervention team to discuss plans to support Brian's learning. An observation by the school psychologist is initially planned to help the teacher gather additional information such as the frequency of the behaviors, and the time and settings where the problem behaviors occur. Brian's teacher and the school psychologist greet him and his mother as he enters the classroom. Brian darts by them, running over to the play area bumping into another child as he proceeds to the toy cars. He scurries from toy to toy as if under a time limit. Brian's mother enters the room behind him, smiling and shaking her head from side to side as he rushes away. His mother visually scans the classroom, commenting to the teacher that there are a lot of things that will be very distracting to him, while pointing at the colorful objects hanging from the ceiling. She also comments that there are a lot of children in the classroom and said that his former teacher said he should be in a class with a smaller number of children. She notes that Brian is "a little on the active side" adding that her husband said he is a typical boy. The teacher asks his mother about his preschool experience and she states that he was enrolled in preschool last year but after a couple of weeks the teacher told her that he was not ready and needed another year "to mature". His mother comments that she planned to send him to preschool this year, but decided that she would send him to kindergarten and "hope for the best". Since there are other parents and children waiting to be greeted, the teacher does not have the opportunity to speak in greater detail with Brian's mother. As his mother departs, she comments that Brian is usually on his best behavior when he first meets someone so she expects that he will "not be a problem" on his first day of school.*

### *Executive Functions*

Each day a child interacts with others he or she is required to use decision making to self-regulate our behaviors. While executive function is not a commonly used term in educational settings. It is a term used to describe those cognitive skills necessary for purposeful, goal-directed activity which help us to organize, plan, reflect on, and persist to finish our work. Executive functions assist us in initiating tasks, drawing upon past knowledge, asking for help, multi-tasking, waiting our turn to speak, evaluating our ideas and thoughts, making midstream corrections to our work, and seeking more information when needed (Chan, Shum, Toulopoulou, & Chen, 2008). There appears to be a correlation between the cognitive skills considered as executive functions and social-emotional development as they relate to inhibiting impulsive behavior and problem solving (Dietzel, 2008). Children having difficulty with social-emotional functions such as distractibility, impulsivity, delayed gratification and the relationship between cause and consequences often show deficits in cognitive skills falling under executive functions (Riggs, Jahromi, Raza, Dillworth-Bart & Mueller, 2006).

Executive functions are mainly controlled by the frontal and prefrontal cortices of the brain and are relatively immature during childhood. Early theorists suggested that executive skills were not efficient until cerebral maturity; however, recent research suggests that they can be elicited in early childhood and continue to develop into early adolescence (Dawson & Guare, 2004; Dietzel, 2008). According to Dietzel (2008), the most rapid development of the executive functions occurs during early and middle childhood and follows a developmental course similar to all cognitive skills (p. 9). Typically, executive functions begin to emerge around one year of age; gradually develop in the areas of inhibition, working memory, attention, and planning around ages 2-5; and at 6 years of age, demonstrate simple planning, visual organization, and basic inhibition skills (Dietzel, 2008).

While there are a myriad of behaviors associated with executive functions, deficits in executive functions can manifest in the way a child plans, initiates, organizes, and monitor his or her behavior; keeps track of information in working memory; regulates his or her emotions and attention; and uses problem-solving and thinking (Dietzel, 2008). As such, executive functions play a fundamental role in a child's long-term functioning and cognitive, and social-emotional/behavioral, and from the time that children begin to interact with their environment, adults have expectations of how they will use these skills to parley many of the demands of childhood (Shaw & Redshaw, 2006).

### *Identification*

Individuals in the fields of medicine, education, and mental health recognize and accept that early identification and assessment of children with academic and behavior problems should guide interventions and help lessen the severity of the problem (Dawson & Guare, 2004; Durlak, 1997; Elliott et al, 2007; National Reading Panel, 1999; Tarazi, Mahone, & Zabel, 2007). These beliefs and practices result from a myriad of research supporting that: (1) a child's behavioral and socio-emotional functioning

during early childhood can be predictive of these skills in later years, (2) there is a strong correlation between a students' classroom behaviors and academic achievement, and (3) the rapid change in motor proficiency and executive functions (EF) takes place during early childhood (Dawson & Guare, 2004; Elliott et al, 2007; Livesey, Keen, Rouse, & White, 2006).

Children who are served in early childhood education programs through the Ohio Department of Education (ODE) and those who are entering kindergarten in the public schools for the first time are required to have their early literacy skills assessed using *Get It, Got It, Go (GGG)* and the *Kindergarten Readiness Assessment- Literacy (KRA-L)*. "Assessment" is the process of gathering information about what a child knows which is also referred to as "screening" or "testing" (ODE, 2007). The ODE requires assessment twice a year of all 3-5 year olds, using GGG, if the children are served in one of the center-based, state funded early childhood education programs. GGG is a brief screening assessment and progress monitoring tool of literacy benchmarks useful in measuring children's risk and progress in critical language and early literacy indicators: picture naming, rhyming, and alliteration. Each child's score is an indicator of individual growth in the three early reading skill areas assessed by GGG.

Children entering kindergarten are also assessed using the KRA-L no sooner than four weeks prior to the start of school, but *no later than* Oct. 1 of that school year. The KRA-L is a brief assessment that looks examines a child's precursory reading skills in six specific literacy areas. Teachers use the results to decide if additional assessment is needed to identify additional concerns that may interfere with a child's reading development and how to build upon the child's strengths and weaknesses in literacy.

Academic or behavior problems have been attributed to deficits in working memory and attention which often occur co-morbidly (Gathercole, Alloway, Kirkwood, Elliott, Holmes & Hilton, 2008; Livesey, Keen, Rouse & White, 2006; Gilmore & Honen, 2008; Powell & Voeller, 2004) or the presence of a significant medical history or diagnosis such as Attention Deficit Disorder, Traumatic Brain Injury, prematurity, or Autism Spectrum Disorder (Hughes, 2002; Isquith, Crawford, Espy & Gioia, 2005). And while each of these disorders has their own unique characteristics, they have one thing in common--a weakness in executive skills (Dawson & Guare, 2004; McGlamery, Ball, Hensley & Besozzi, 2007).

While many of the behaviors associated with executive function deficits are not uncommon in young children, educators are challenged to determine which of the youngsters' abilities require special education. And although performance judgments by teachers are often accurate in determining student achievement (Hoge & Coladarci, 1989), a majority of teachers tend to function within a "wait-to-fail" model of identifying or referring students who may be experiencing educational difficulties (Elliott et al, 2007).

At Brian's parent-teacher conference, his teacher shared concerns about his skills and progress and requested the parent that they meet with the school-based intervention team to determine how to proceed. The kindergarten teacher indicated that her greatest concern was that Brian did not maintain attention long enough to complete assigned tasks without constant redirection from his teacher. When asked if they experienced challenges with him at home, the parents said that Brian does not sit still except to watch television, and does not do what he is told. They said when asked to do something, he has to be told several times. They added that he has also been experiencing difficulty at swimming lessons and at Sunday school with complaints being that he does not listen to his teachers.

In the case of Brian, his teacher's experience, knowledge of child development, and observations led her to be concerned about Brian and request additional support by the school-based intervention team. Through some assessment with Brian (see Table 1) by the school psychologist and speech and language pathologist collaborated with the teacher and additional team members to determine how to proceed to address Brian's behavioral and academic needs.

#### *Assessment*

Research indicates that assessment of executive functioning in young children is not done because executive function is difficult to define, and challenging to assess due to the broad range of normal variability in these functions, and limited developmentally appropriate measures (Chan et al, 2008; Elliott et al, 2007; Filley, 2000; Isquith et al, 2005; Miyake et al, 2000). Others suggest that there are various tools (see Table 1) which can be useful in evaluating executive functions in young children; however they encourage the use of multiple measures or a battery of tests, beyond IQ tests and achievement tests, as part of the assessment process to guide instruction and interventions (Barkley, 2001; Chan et al, 2008; Delis et al, 2007; Elliott et al, 2007; Gilmour & Hohnen, 2008; National Reading Panel, 1999; Powell & Voeller, 2004). Yet, while there is no recipe for assessment of academic and behavior functioning with skills regarding executive functions during childhood, performance based measures which evaluate the impact of executive function deficits in authentic settings to ensure ecological validity is recommended (Isquith, Crawford, Espy & Gioia, 2005).

Whereas direct assessment and use of standardized test scores are of some value, they do not offer the insight that is available through interviews and observations (i.e.: play-based, structured) of daily behavior seen over time in an environment that is familiar and natural for the child. Interviews can yield invaluable information about a child's developmental and medical background (e.g., birth history, milestones, childhood illnesses) which may impact their behavior and school performance (Salt & Redshaw, 2006). A comprehensive, multifactored evaluation, must be conducted in order to gather information about the child's cognitive ability, working memory, language skills, fine motor skills, psychomotor speed, planning, organization, and decision-making skills (Chan et al, 2008; Elliott et al, 2007; Isquith et al, 2005) and resulting educational needs.

Findings from the multi-factored evaluation provide additional information about the child's level of functioning, and offer greater insight into the child as a learner.

Brian's teacher and intervention assistance team recognize the importance of evaluating a student using multiple methods and judging the child's performance in everyday situations and not solely depending upon assessments using standardized tests. The school-based intervention team determined that additional information about Brian was needed in order to develop an appropriate intervention plan. His teacher was following the intervention process dictated by the Individuals with Disabilities Education Act (IDEA), which stipulates that when there is an academic or behavior concern about a student, data from interventions must be collected and appropriate instructional practices and interventions must be developed, implemented, and used to determine eligibility for special education services (Individuals with Disabilities Education Improvement Act, 2004).

The school-based intervention assistance team developed a comprehensive plan in which data could be gained to help determine his present levels, strengths and weaknesses: (1) observations by the school psychologist; (2) completion of behavior checklists by his parents and teachers ; and (3) formative assessments by the kindergarten teacher. Formative assessments included using performance based assessments, curriculum-based measures and classroom-based assessments were included to determine if Brian is achieving cognitively and socio-emotionally at a level comparable to a typical peer. The team agreed to reconvene in two weeks to share their findings and develop a plan for intervention based upon the collected data.

While there exists a variety of different instruments to assess executive skills (see Table 1), the school-based intervention team selected the Behavior Rating Inventory of Executive Function Preschool Version (BRIEF-P), AIMSweb Early Literacy and Early Numeracy, and Behavior Assessment System for Children-Second Edition, Preschool as best for providing the needed information to help identify Brian's early learning and social/emotional behavior needs. Rating scales completed by Brian's teacher and parents showed similar results, and indicated that Brian has elevated levels of impulsivity, attention problems, hyperactivity, as well as deficient social skills and adaptability. Early Literacy and Early Numeracy testing suggested that he has many of the foundational skills for reading and math; however his limited attention interfered with him completing some of the tasks. Classroom observations by the school psychologist found that Brian demonstrated somewhat elevated levels of off-task behaviors as compared to his male peers, however the task, and time demanded to complete the task had a major impact on his success. When off-task, Brian was often seen out of his seat, talking out of turn, and seeking attention from his teacher. Such data was used to validate his teacher's concerns and observations.

Table 1  
*Screening and assessment instruments to assess executive skills\**

INSTRUMENT	EXECUTIVE SKILL
*Behavior Rating Inventory of Executive Function Preschool Version (BRIEF-P) for 2.0 through 5.11; Behavior Rating Inventory of Executive Function (BRIEF) for ages 5-18	Inhibition, cognitive shifting, initiation, emotional control, planning/organization, self-monitoring, working memory
Stroop Color-Word Interference Task	Inhibition
Brief Academic Competence Evaluation Scales System	Reading, mathematics and behavior
Comprehensive Inventory of Basic Skills	School Readiness
Battelle Developmental Inventory	Adaptive, personal-social, communication, motor abilities & cognitive skills
*AIMSweb	Early reading and mathematics abilities
Dynamic Indicators of Basic Early Literacy Skills (DIBELS)	Early reading abilities
*Behavior Assessment System for Children-Second Edition, Preschool	Social-emotional, behavior functioning
Social Skills Rating System	Social-emotional, behavior functioning
Teacher Report Form & Child Behavior Checklist	Social-emotional, behavior functioning
Conners' Rating Scales	Inattentive, Hyperactive, Oppositional behaviors
Systematic Screening for Behavior Disorders	Social-emotional, behavior functioning
Contingency Naming Test	Cognitive flexibility
Delis-Kaplan Executive Function System	Executive function
Tower Tests: Tower of Hanoi or Tower of London	Planning abilities
Matching Familiar Figures Test	Reflection, impulsivity
Trail Making Test or Trails-P test	Motor planning, inhibition, cognitive shifting
Wisconsin Card Sorting Test or Dimensional Change Card Sorting	Cognitive flexibility, concept formation
Go NoGo	Inhibitory control
Shape School	Inhibitory processes
Motor Impersistence Test	Motor control

*\*Screening and assessment instruments used to gather information specific to Brian*

*Intervention*

Executive function deficits are related to an individual's working memory, attention, distractibility, work quality, work completion and problem-solving (Hughes, 2002; Gathercole et al, 2008). These deficits can have a significant impact on a child's school performance. Children with executive function deficits require modification in the way in which they are managed in the classroom and require team collaboration because of the need to review, change, and adjust the management plan over time (Powell &

Voeller, 2004). As a result, executive function deficits need to be identified and addressed early on in a child's educational programming and predicated on sound assessment tools and decision-making rules (Elliott et al, 2007).

Children with executive functioning deficits need a structured, organized environment in which rules, expectations and consequences are clearly communicated. Teachers need to structure their schedule and environment to minimize distractions (Dawson & Guare, 2004).

Instructional adaptations include task analysis where assignments are broken into manageable steps, a child is provided extra time, visual schedules and supports such as diagrams and outlines, and tactile interventions which include manipulatives and hands-on learning. Additionally, a buddy system is a way to encourage peer interactions, appropriate play, and social development (Lentini, Vaughn, & Fox, 2005).

In the case of Brian, his teacher was proactive in seeking support from her school-based intervention assistance team. She used her knowledge, observations and data from assessments to support her concern and plan for intervention. Through the team process, some assessment was completed which helped identify some behaviors commonly associated with a deficit in executive functioning. As a result intervention was initiated.

Brian's plan focused on teaching him how to regulate his behavior, and how to manage time, space, and materials. The teacher met with the speech and language pathologist to create visual cues, and visual stories. The teacher also collaborated with the school psychologist to develop checklists and a daily report card/reinforcement system. As children with executive function deficits often have difficulty generalizing actions across settings (Powell & Voeller, 2004), it was necessary for his teacher to re-teach behaviors when he was in different settings. She sometimes did this through use of peer models, social stories or through role playing. The school counselor and speech and language pathologist supported her with these tasks. His teacher provided him with proximal seating near her and/or peer role models so that he would imitate appropriate work related behaviors and receive extra help and feedback from his teacher immediately and frequently during the initial phase of the intervention.

At the start of each day, Brian's teacher reviewed his daily schedule and then reviewed the daily calendar with the entire class. This provided him with additional reminders of the school day. She also paid special attention by highlighting changes and transitions on his schedule. His teacher provided step-by-step guidance, routine and consistency, and supplemented oral directions with visual supports and verbal cues.

Since managing space and materials is challenging for Brian, his teacher helped him keep his workspace organized and free of unnecessary clutter or materials. She provided him with a separate workstation with only the needed materials in each station to help his organization and help reduce distractions. She did this by providing time every week for cleaning and organizing his workspace with a peer or adult helper.



Brian's teacher modified his work into manageable segments and used a checklist for work completion as it was noticed by the school psychologist that he could complete his work more often when there was a smaller amount of work and when he knew exactly what to do. Use of a checklist and visual schedule helped Brian visualize when his work was done. His teacher found this to be very reinforcing for him because he was proud to have a visual representation of his accomplishments for the whole class to see.

Brian was provided with visual supports because of the variability in his attention. Visual schedules, calendars, and checklists were valuable tools that provided him with a visual representation of their day, predictability in their day and an understanding of the course of their day (Dietzel, 2008). Brian's teacher also taught him how to use a timer to help complete his work within the allotted time. Tools such as a timer or watch can help the child organize their day and the activities within their day.

His teacher and parent agreed to use a daily report card for work completion. The report card clearly stated the expected behaviors and outcomes. The report card described what Brian needed to do and what he would receive as rewards and consequences of his behavior. Brian's teacher identified three behaviors that would be monitored throughout the day. The goal was for Brian to complete a modified task with two or fewer verbal or physical cues. This would be accomplished by having Brian use a timer for work completion, show his work to his teacher as it was completed, use a visual checklist to cross off each task as it was completed and remain in his designated area while working. If Brian attained his goal, he would get a "thumbs up" symbol for home. If he partially met his goal, the thumb would face the middle. If he did not reach his goal, the thumb faced downward. The chart would go home at the end of every day and the parent would initial below the thumb to designate that the plan had been seen. This plan not only provided Brian with guidelines for what was expected of him at school, it was reinforced at home.

Brian's parents provided home reinforcement and consequences as a follow-up to his school day. When Brian attained his goal for the day, he was allowed to choose one activity from a list of options agreed upon by his parents. If Brian earned a reward the parent would state what he earned so the teacher could discuss it with him the next day. Brian's progress was documented daily and the fidelity of the intervention was monitored by the school psychologist who helped the teacher change the intervention and reinforcers as needed. The home support was also an integral part of the success as he was pleased to share his successes with his parents.

By the end of the year, Brian had made marked improvements in his ability to sustain mental effort to complete his work. Classroom and curriculum-based assessments conducted once or twice a month by his teacher determined that he was progressing adequately. His teacher reported that she was glad that she had identified his needs early on and intervened before the behaviors had an adverse effect on his academic performance. She also noted that she was glad to have had experience working with students with behavior challenges as she believed that contributed to her early

identification of a problem and collecting the essential information to start intervention. His teacher was pleased with the process and his growth over the year, although it took a team approach and year of intervention. On occasion, his teacher questioned how Brian may have entered kindergarten had he participated in preschool and had early intervention prior to starting school.

### Conclusion

While there is not one treatment or intervention to address executive functioning deficits in young children, early assessment and intervention can improve outcomes for children at biological risk and as executive function deficits can impact the long-term success of an individual, appropriate age and ability level strategies for building capacity for greater independence should be initiated early on in a child's education (Dietzel, 2008; Salt & Redshaw, 2006). Unidentified executive function deficits can result in significant learning and behavior problems and a more comprehensive assessment, which includes assessment of executive function, can yield accurate data that can be used to connect instruction to valued educational outcomes and more quickly identify those students in need of instructional refinements and more intensive interventions.

In summary, it is recognized that executive functions play a fundamental role in the cognitive and social-emotional/behavioral functioning of young children. Therefore, it is imperative that assessment and intervention be provided at the earliest opportunity in order to enhance a child's academic performance, and minimize the potential for social and behavior problems.

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