

A Framework for Addressing the Needs of Students Prenatally Exposed to Alcohol and Other Drugs

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ABSTRACT: In this article, the authors review learning and behavioral problems of children exposed prenatally to alcohol and other drugs, focusing on executive-function deficits such as difficulty shifting tasks, maintaining attention, and manipulating information in working memory. They discuss various risk factors associated with prenatal drug exposure so that educators can better understand the nature of the disorder and choose more effective classroom interventions that address the deficits of these students.

KEYWORDS: *attention, executive function, interventions, prenatal exposure to alcohol and drugs, working memory*

DURING THE PAST DECADE, the number of children born to mothers who abused alcohol and other drugs during their pregnancy has increased dramatically. According to the National Institute on Drug Abuse (1996), approximately 5.5% of pregnant women use an illicit drug during pregnancy. These figures are alarming, particularly when considering that the risk factors associated with prenatal drug and alcohol exposure are varied, complex, and long lasting.

Research on children prenatally exposed to drugs and alcohol reveals the numerous negative effects of maternal alcohol or drug use on infants and young children (Bateman & Chiriboga, 2000; Chiriboga, Brust, Bateman, & Hauser, 1999; Gottwald & Thurman, 1994; Sinclair, 1998; Vathy, 1995). Many problems that are not apparent during infancy can appear at an older age (Hans, 1996). For example, language disorders and neurobehavioral problems may go undetected until the child is required to perform more cognitively demanding tasks, often when entering school (Watson & Westby, 2003a, 2003b). In general, children exposed to drugs and alcohol are susceptible to a range of developmental problems that can impinge on and negatively influence teaching and learning.

Educators have not always recognized or understood the nature of the learning and behavioral difficulties experienced

by students prenatally exposed to alcohol and other drugs. Consequently educators have often underserved these students. Watson and Westby (2003a) interviewed school professionals and observed a number of teachers working with students prenatally exposed to drugs or alcohol. They found that school personnel often neglected the needs of these children. In a related study, Watson (2003) surveyed general and special education teachers and speech-language pathologists from five school districts and found that all three groups agreed that they needed (a) knowledge about this population of students and (b) more training and information on how to teach and modify instruction for them. Watson, Gable, and Tonelson (2003) surveyed university faculty regarding preparation of general educators, special educators, and speech-language pathologists to work in schools with students prenatally exposed to alcohol and other drugs. The results confirmed that, in general, teacher education and speech-language pathology programs provide limited information to either preservice or inservice professionals on students who have been prenatally exposed to drugs and alcohol. Last, Kim, Sugai, and Kim (1999) surveyed preschool educators and reported that 88% of respondents acknowledged they

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needed more information on educating children prenatally exposed to alcohol and other drugs.

Many students who were exposed to drugs and alcohol are now in or will soon enter the school system. Given the harmful effects of alcohol and drugs, it is important that education professionals have knowledge of the effects of prenatal drug exposure on teaching and learning. In this article, we discuss the common learning and behavioral characteristics of children prenatally exposed to alcohol and other drugs, highlighting executive-function deficits as the basis for many of these children's learning and behavioral problems. We present a framework for executive functioning proposed by Barkley (1997, 2000) and show how strategies that have been considered best practices for developing executive functioning in students with traumatic brain injury (TBI), learning disabilities (LD), attention deficit hyperactivity disorder (ADHD), and autism can be used to address the academic and social needs of children who have been prenatally exposed to alcohol and other drugs.

Characteristics of Students Prenatally Exposed to Drugs and Alcohol

Researchers indicate that there are clusters of characteristics present in most students who were prenatally exposed to drugs or alcohol (Delaney-Black et al., 2000; Hubbard, 1998; Mattson, Schoenfeld, & Riley, 2001; Sinclair, 1998; Soby, 1994; Watson & Westby, 2003a). The physical, cognitive, academic, social, and emotional impairments of these students can range from mild to severe. Typically, these students exhibit learning difficulties manifested in fine-motor-control deficits, auditory processing deficits, language delays and disorders, and mathematical comprehension difficulties. For some children, these deficits may exist in the presence of relatively normal performance on traditional IQ measures (Connor, Sampson, Bookstein, Barr, & Streissguth, 2000; Kerns, Don, Mateer, & Streissguth, 1997; Kodituwakku, May, Clericuzio, & Weers, 2001). The students also may exhibit a variety of social-emotional behavioral difficulties. For example, some children are overly friendly and social to all persons, others are defiant and aggressive, and others may be socially withdrawn (Cohen & Erwin, 1994; Delaney-Black et al.; Sinclair; Watson & Westby, 2003a).

Executive Function Deficits

Researchers have characterized many of the difficulties exhibited by students prenatally exposed to alcohol and other drugs as deficits in executive function and other cognitive processes (Connor et al., 2000; Kodituwakku, Kalberg, & May, 2001; Mattson, Goodman, Caine, Delis, & Riley, 1999). Ylvisaker, Szekeres, and Feeney (1998) defined *executive function* as a group of control functions that direct and regulate cognitive behavior (e.g., paying attention, remembering information) and social behavior (e.g., being polite around people you do not like). Deficits in executive function

include difficulties with self-regulation, poor attention, distractibility, and difficulty organizing and planning behaviors (Barkley, 1997; Ylvisaker et al.). Researchers have documented problems with executive function in individuals with a variety of disorders, such as autism, ADHD, LD, and TB and in children who have been exposed to alcohol and other drugs (Barkley, Edwards, Laneri, Fletcher, & Metevia, 2001; Ewing-Cobbs, Levin, & Fletcher, 1998; Hardan, Minshew, & Keshavan, 2000; Russell, 1997).

Students who have been prenatally exposed have particular difficulty (a) learning new material (e.g., encoding information), (b) shifting or changing strategies (e.g., being flexible in problem-solving), and (c) knowing when to apply certain rules in daily situations (e.g., asking permission to leave the room; Coles, 2001; Connor et al., 2000; Kodituwakku, Kalberg, et al., 2001). Thus, students with prenatal alcohol and drug exposure have problems with attention shifting, working memory, abstraction, planning, and problem solving.

Barkley (1997, 2000) proposed a model of executive functioning in which deficits in the ability to control behaviors adversely affect the development of four components (described below) of executive function in which deficits in behavioral inhibition influence the development of other components of executive function. Behavioral or response inhibition involves the ability to inhibit impulsive responding, stop inappropriate or ineffective behavior, and shield oneself from distractions. Deficits in behavior inhibition disrupt working memory, which is the capacity to hold mental representations in mind and manipulate the representations to guide behavior. This negatively influences a student's ability to self-regulate mood and motivation and integrate behaviors to achieve goals.

1. *Nonverbal working memory* involves the ability to recognize and remember the relationship of present events to previous experiences. Using nonverbal working memory, individuals form mental models to visually represent activities and events. This executive function underlies a student's ability to imitate complex sequences of behaviors. The ability to use nonverbal working memory for developing mental models also enables the student to activate past events, which allows for hindsight, forethought, and a sense of time.

2. *Internalization of self-directed speech or verbal working memory* involves the use of language to code nonverbal mental models. Individuals use this linguistic coding to self-talk and to describe, reflect, self-instruct, and question. This results in the internalization of rules to manage behavior and guide moral reasoning. By internalizing the language of instruction and rules of behavior, a student is able to act appropriately when adults are not around. Without internalized speech, students may not succeed in developing an appreciation of rule-governed behavior; without this, they will have difficulty in regulating their own behavior.

3. *Self-regulation of mood, motivation, and level of arousal* involves the ability to moderate feelings, motivate oneself in the absence of external consequences, and arouse oneself in the pursuit of future goals. This self-regulation depends on the ability to visualize or conceptualize an experience or idea (nonverbal working memory) and use language (verbal working memory) to describe and reflect on one's moods and emotions and the moods and emotions of others.

4. *Reconstitution, or problem solving*, is the ability to analyze observed behaviors and synthesize new behaviors in pursuit of a goal. Reconstitution is essential for all problem solving, and it requires the integration of all three other components of executive function (i.e., nonverbal and verbal working memory and self-regulation of mood, motivation, and level of arousal). If students have deficits in other aspects of executive function, they will have deficits in problem solving.

These components of executive function build on one another and are highly interactive. Students who have problems in areas of executive function often lack awareness of their behavior, emotions, and thought processes. Consequently, these students have difficulty adjusting their behavior in response to the social and physical environment. They also find it difficult to plan short- and long-term behaviors and goals. Last, executive-function deficits can impair a student's ability to see cause-and-effect relationships, control impulses, and display appropriate social behaviors (Denckla, 1996; Kodituwakku, May, et al., 2001).

Evaluation of Executive-Function Deficits

Educators have typically used several tasks to evaluate executive functioning. Teachers do not have to have the formal tests to complete the activities; instead, they can use available materials to assess students. We group the following assessment tests by what they measure:

Nonverbal Working Memory

Wechsler Memory Scale—Revised Visual Reproduction (VMS-RVR; Wechsler, 1987). In this subset, a child is presented with four designs and asked to look at each design for 10 s and immediately draw the design when it is removed. Approximately 30 min later, the child is asked to draw each design again. This subtest measures nonverbal learning and working memory. The tasks require simultaneous storage and processing of information.

Verbal Working Memory

Word fluency or letter–word fluency. Verbal fluency tests, known by several terms (e.g., controlled oral word association), include tests of letter and semantic fluency. Several child cognitive and language assessments ask children to name in 1 min as many items as they can that belong to a

category (e.g., animals, things to eat, things to wear). Older children and adults are asked to generate as many words as possible that begin with particular letters (Benton, Hamster, Varney, & Spreen, 1998). Verbal fluency tests have two components that are associated with frontal-lobe function: linguistics and ideation. Performance is assumed to reflect automatic lexical access, efficient lexical production, working memory, and the ability to self-monitor, initiate, and shift. However, performance is not independent of intelligence, vocabulary skill, or attention.

Competing Language Processing Task (Gaulin & Campbell, 1984). This task places demand on working memory. The student is asked to read simple sentences (e.g., “Trees have leaves”; “Babies drive trucks”). Groups of sentences are presented in increasing set sizes, from two to six sentences. The student first must respond to the truth value of each statement by indicating whether the statement is true or false and then remember the last word of each sentence.

Digit span backward. The task of reciting numbers backward appears on several language and cognitive tests (e.g., Wechsler Intelligence Scale for Children, 3rd ed.) and demands working memory because it requires both storage and processing of information.

Self-Regulation and Problem Solving

Trail Making Tests A and B (Reitan, 1992). This device measures several cognitive domains, including psychomotor speed, cognitive flexibility, divided attention, sequencing, and visual tracking. Trail A consists of numbers randomly placed on a page. The participant draws a line from one number to the next in sequential order. Scoring is based on accuracy and time. Accurate performance on this test relies on attention and visual-motor speed and tracking, intact visual-directional scanning, and the handling of serial information. Trail B has both numbers and letters randomly scattered on a page. The participant alternates drawing a line between numbers and letters in sequential order (e.g., 1, A, 2, B, 3, C). Trail B particularly taps executive functioning (e.g., planning and cognitive flexibility). Trail Color is a version adapted for use with children and is designed to minimize any effects of reading ability (D'Elia & Satz, 1989).

The Stroop color and word test (Trennery, Crosson, DeBoe, & Leber, 1988; Golden & Freshwater, 2002). This well-known and highly researched assessment tool uses cards with the names of colors spelled out (e.g., blue) but printed in the ink of another color (e.g., red). The student is then instructed to say the name of the ink rather than the word. This task requires the student to inhibit the normal tendency when reading, which is to attend to the word and ignore the ink color. It is a short measure of *selective or focused attention*—the ability to change a

TABLE 1. Interventions for Students Prenatally Exposed to Alcohol and Other Drugs, by Executive Function

Executive function	Characteristics of deficit	Assessment of executive functions	Examples of observable behaviors	Target of intervention	Intervention options
Nonverbal working memory	Difficulty remembering events or information Difficulty imitating complex sequence of behaviors Diminished sense of time Limited self-awareness Defective hindsight and forethought	Wechsler Memory Scale-Revised Visual Reproduction (VMS-RVR) Subtest	Impulsivity Hyperactivity Inattention Inability to remember materials, deadlines for assignments Inability to complete tasks previously learned Inability to reach school and events on time Inability to judge the time needed to complete tasks Inability to select the right behavior for the social situation because of failure to learn from previous experiences	Internal: Develop nonverbal mental representations of actions and events External: Provide a structured environment with visual cues to support behavior	Visualization training Self-awareness training: Videotaping corrective feedback Consistent and structured environment Structured daily routines Visual cues Visual schedules Use of checklists to check off assignments completed
Internalization of self-directed speech or verbal working memory	Reduced description and reflection Difficulty self-questioning and problem solving Deficient rule-governed behavior (instruction) Ineffective generation of rules or metarules Delayed moral reasoning	Verbal Fluency Tests (e.g., FAS) Competing Language Processing Task Digit Span Backwards Letter-Number Sequencing Task	Impulsivity Hyperactivity Inattention Follow rules only when adults are present Deny wrongdoing Lie about behavior Difficulty with reading comprehension Do not have or use previous learned strategies to repair a mistake Difficulty distinguishing right from wrong	Internal: Develop receptive language to comprehend instructions Develop expressive language skills to describe sequence of actions and events Increase the range of language functions	Language interventions to develop semantic, syntactic, and pragmatic skills. Cognitive-behavioral interventions: Cognitive modeling Verbal mediation Link visual cues to verbal prompts

Self-regulation of mood, motivation, and level of arousal	Difficulty regulating own feelings Difficulty with self motivation Poor self-regulation of arousal and goal-directed action Low frustration and tolerance	Delis-Kaplan Executive Function System (D-K EFS) Trail Making Tests, A and B The Stroop Color and Word Test Stop Signal Task	Impulsivity Hyperactivity Inattention Dependent on external sources to motivate or regulate behaviors and emotions Easily frustrated and angered Give up easily Insensitive to the thoughts and feelings of others Say whatever comes to mind, regardless of the consequences (e.g., frequently make comments that alienate them from peers and family members)	Internal: Develop language for self-reflection	Vocabulary of emotions Social-skills instructions Repeated opportunities to role play social skills External reinforcement of desired behaviors to foster motivation
Reconstitution or problem solving	Difficulty analyzing and synthesizing behaviors Difficulty problem solving	(D-K EFS) Raven's Progressive matrices Tests Wisconsin Card sorting Test	Impulsivity Hyperactivity Inattention Difficulty reflecting on own behavior Difficulty generalizing behaviors or information learned from one situation to a new context Do not have long-term realistic goals	Internal: Develop self-determinism	Self-determination curricula Cognitive modeling Coaching (i.e., scaffolding and questioning students during interactions)

Note. From "Strategies for Addressing the Executive Function Impairments of Students Prenatally Exposed to Alcohol and Other Drugs," by S. M. R. Watson and C. E. Westby, 2003, *Communication Disorders Quarterly*, 24, pp. 194–204. Copyright © 2003 by the Hammill Institute on Disabilities. Adapted with permission.

response when presented with a novel one—and inhibition (Baron, 2004; Lezak, 1995). An adapted version of this task for young children (Gerstadt, Hong, & Diamond, 1994), the *Day-Night Stroop*, includes two kinds of cards. One face of half of the cards is white with a bright sun, to which the child is instructed to say “night.” The other half of the cards have a black face with a moon and stars, to which the child is told to say “day.”

Wisconsin Card Sorting Test (Grant & Berg, 1993; Heaton, 1981). This test, which can be used with people from 6.5 years old through adulthood, measures inhibition, abstract reasoning, sustained attention, strategic planning, organized searching, problem solving, and the ability to use feedback to shift cognitive sets and direct behavior. Four cards varying in color, shape, and number are placed in front of the student. The student is asked to match cards from the two decks with one of the four key cards, and the examiner tells the student whether the cards were sorted correctly. After 10 consecutive correct matches, the sorting principle is changed without the student’s knowledge, and the examiner gives negative feedback to the student on his or her previous successful strategy. The student’s score reflects the ability to inhibit previous response patterns and a shift to a new response set. Poor performance reflects ineffective hypothesis testing and perseverance and difficulty maintaining a mental set in the presence of competing stimuli.

Children and adults with executive-function deficits (e.g., ADHD) generally exhibit poorer performance on the aforementioned instruments than do those without executive-function deficits (Lovejoy et al., 1999; Marton & Schwartz, 2003; Pineda, Ardila, Rosselli, Cadavid, & Mancheno, 1998).

Several researchers indicate the tasks are mediated by the prefrontal areas of the brain, which are responsible for executive functioning (Barkley, Murphy, & Bush, 2001; Baron, 2004; Lovejoy et al., 1999; Pineda et al., 1998). Frattali and Grafman (2005) recommended the assessment of the full range of behaviors that are presumed to be impaired. This included the assessment of executive function and language or discourse areas, which will provide an understanding of their relationship and the causal nature of the deficits. Traditional language tests, such as Clinical Evaluation of Language Fundamentals–4 (Semel, Wiig, & Secord, 2003) or the Comprehensive Assessment of Spoken Language (Carrow-Woolfolk, 1998), can be used to assess students’ language abilities.

Programming for Students Prenatally Exposed to Alcohol and Other Drugs

Education personnel must select and implement programs of interventions. If the interventions are not carefully matched to a student’s specific needs and carried out systematically and intensively, they are not likely to produce large,

long-term, and generalized results (Abikoff, 1991; Gresham, Sugai, & Horner, 2001; Jensen, Hinshaw, & Kraemer, 2001; Shapiro, DuPaul, & Bradley-Klug, 1998). School personnel must identify not only the areas of the deficit but also the nature of the deficit (e.g., knowledge, performance, fluency). Students with knowledge deficits do not have the information or skill in their repertoire or do not know how to use a skill in a particular situation. Students with performance deficits have the knowledge and skills, but they fail to use them at acceptable levels. Fluency deficits are the result of insufficient exposure to models of the behaviors, insufficient opportunities to practice the behaviors, or inconsistent reinforcement of their performance of the behaviors. Table 1 presents various evidence-based interventions, along with characteristics of executive-function deficit, examples of assessment instruments, examples of observable behaviors of the deficit, and the target of the intervention.

Teachers can use cognitive modeling through role-play situations to teach students the problem-solving and self-regulation skills necessary for self-determination. Teachers, however, may have to coach students during emotional interactions to help them remember the skills in real situations. Coaching involves questioning students during interactions so they can learn how to plan to compensate for skill deficits and reach their goals (e.g., “I see that you are having a hard time starting your assignment. What should you do when you do not know what to do?”). Teachers should look for daily opportunities (e.g., getting in line, preparing for a lesson, playing a game) for scaffolding interactions and introduce temporary supports that can be systematically withdrawn as the student internalizes the strategy; if opportunities do not normally occur, the teacher may need to create chances for students to engage in the behavior. Shure’s (2001) interpersonal cognitive problem-solving program, *I Can Problem Solve*, is one source of information on scaffolded problem-solving steps for teachers.

With parental permission, educators may videotape students when they are engaged in inappropriate behaviors and have them evaluate their actions through a self-rating scale with adult guidance. Then teachers would assist the students in setting goals for developing compensatory skills to offset their executive-function deficits. These and related activities will facilitate students’ awareness of their own behaviors and help them set realistic goals (Crosson, 1996; Ylvisaker et al., 1998).

Conclusion

Educators should not assume that every child who exhibits executive-function difficulties has been prenatally exposed to alcohol and other drugs. However, it is important to recognize the characteristics of executive dysfunction, regardless of its cause, if students are to receive appropriate interventions. Having knowledge about the students’ prob-

lems, collecting information about students and their behavior, and completing a functional behavioral assessment to determine the function of the behavior will help teachers to accommodate students' needs better (Buck, Polloway, Kirkpatrick, Patton, & Fad, 2000) and avoid misinterpretations of students' academic and social behavior problems (e.g., calling students "stubborn" when they do not follow directions, or calling them "lazy" when they do not complete assignments). For example, knowing that the student has a disorder of biological origin and that the disorder is associated with deficits in self-regulatory behaviors (e.g., ADHD and prenatal exposure to alcohol or drugs), educators will implement interventions to compensate for the student's problems (e.g., using verbal and visual cues and providing shortened assignments). Therefore, informed teachers will neither require the student to sit still for long periods of time nor will they punish the student for not paying attention because educators will be considering the behavior as a manifestation of the student's disability.

A growing number of students suffer the negative effects of maternal drug abuse. For that reason, providing quality education to children who are at risk because of prenatal drug or alcohol exposure is becoming the shared responsibility of general educators, special educators, and support personnel (Coleman & Webber, 2002; Vincent, Poulsen, Cole, Woodruff, & Griffith, 1991). According to Kerns et al. (1997), school personnel need to understand the nature of these students' deficits to assist them in the classroom. These children may not have identified disabilities, but they are biologically and, many times, environmentally predisposed to having neurobehavioral, educational, social, and emotional problems. It follows that, in planning and developing educational programs, school personnel must be able to accurately assess how the children's physical and cognitive difficulties may impact the teaching-learning process. Educators must be able to identify students' strengths and weaknesses and develop pupil-specific classroom interventions that are aligned with diverse learning needs. School administrators should better prepare and support educators facing the challenges these students pose to successful classroom instruction. System-wide program efforts that emphasize early intervention would go a long way in addressing the social, emotional, and academic needs of this heterogeneous group of students.

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