

Contributors to the social goals and outcomes of students with ADHD with and without LD

Sydney S. Zentall*

Purdue University, 100 N., University Street, West Lafayette, IN 47907, USA

Abstract

There is a significant overlap between attention deficit hyperactivity disorder (ADHD) and learning disability (LD) student populations. The inattentive subtype of students with ADHD, in particular, is difficult to differentiate from students with LD. What differentiates between these groups can be seen in their regulation of behavior and attention to attain different goals. In turn, their behavioral choices alter the social context and the social context alters their outcomes. These outcomes are increased emotionality and sensitivity to positive and negative social feedback, negative future expectations, as well as decreased social and academic participation and prosocial response. The educational implications presented are related to their primary goals and the long-term outcomes they experience.

© 2006 Elsevier Ltd. All rights reserved.

The major purpose of this paper is to profile students with attention deficit hyperactivity disorder (ADHD)—their social and emotional outcomes and the mediators of these outcomes. To this purpose, I will first discuss biogenetic contributors to ADHD and then describe how these biogenetic factors alter (a) the behavioral style, social goals, and social outcomes of students with the hyperactive/impulsive subtype (ADHD-H) and (b) the attentional style, social goals, and academic and social outcomes of the inattentive subtype (ADHD-I) differently from and similar to students with learning disability (LD). Understanding the social goals of children, who represent the most frequently identified disorders of childhood (Willcutt et al., 2001), can help us understand their behavior and response to feedback over time.

*Fax: +1 765 496 1228.

E-mail address: zentall@purdue.edu.

Reading disabilities and ADHD are multiply determined by biogenetic and environmental etiologies (e.g., disease, trauma) that contribute to abnormalities in the structure or chemistry of the brain. Researchers have speculated about which areas of the brain may be especially vulnerable to insult. Pennington (1991) suggested that areas of the brain that have evolved most recently in the history of the human species would be more likely to be affected by genetic and environmental variation. These are (1) the prefrontal cortices, which are involved in planning, response inhibition, selective attention or visual search, maintenance of attention, self-monitoring, recognition memory, and (2) the left hemispheric language functions, which are involved in phonological processing (Pennington, 1991; Pennington & Ozonoff, 1996). Left hemispheric dysfunctions have been found in association with language learning disabilities and dyslexia (Shaywitz & Shaywitz, 1991).

Even though the evidence indicates that ADHD and LD are biogenetically based, it does not tell us why these groups of children demonstrate predictable responses to specific conditions. Differences in the structure of the brain can alter the way children learn, as would be the case for children with LD. For students with ADHD, the behavioral pattern of hyperactivity and failure to inhibit activity is a consistent response to specific stimulus conditions and appears to be related to differences in arousal.

Arousal is the physiological activation of individual organisms. Several early theorists have postulated that learning and behavioral efficiency are dependent on the maintenance of an optimal level of non-specific activation (i.e., the optimal stimulation theory, Berlyne, 1960; Hebb, 1955; Leuba, 1955). Activation is dependent on the amount of external stimulation available in the setting and time period, as well as, what is provided internally by child factors, such as fatigue, hormonal levels, drugs. Effective levels of arousal can also be due to individual differences in initial sensitivity to and rates of habituation to stimulation (Allen, 1986; Satterfield, Schell, Nicholas, Satterfield, & Freese, 1990). When external and internal stimulation are not optimal, individuals attempt to regulate their own stimulation by altering level and variability of activity.

This homeostatic theory was later applied to students with ADHD, hypothesizing that suboptimal levels of physiological arousal could explain their high levels of activity (Zentall, 1975; Zentall & Zentall, 1983). In response to suboptimal arousal, the hyperactive/impulsive subtype (ADHD-H) and the combined subtype (ADHD-C) generate stimulation by moving and talking (hyperactivity) and by failing to inhibit active responses (impulsivity) (for subtype definitions, see the *Diagnostic and Statistical Manual of Mental Disorders* fourth edition (American Psychiatric Association, 2000). In other words, what differentiates individuals with ADHD from students with LD is a greater than normal need for stimulation or lack of tolerance for suboptimal states of biological activation. These physiological differences contribute to a behavioral and attentional style that is associated with a set of social goals and social/emotional outcomes.

1. Hyperactive/impulsive subtype: behavioral style, social goals, and outcomes

The social behavioral style of students with ADHD-H (and -C) is observed in dyadic and small group interactions. When engaged in social interactions, students with ADHD were observed to talk more (comments unrelated to the task, negative verbal statements, disruptive noises) and use less positive rough play (Cunningham & Siegal, 1987; Hubbard & Newcomb, 1991; Madan-Swain & Zentall, 1990; Zentall, Kuester, & Craig, 2006). When

students with ADHD were further separated into those who were liked and disliked, disliked students were characterized by the negative quality of their verbal and non-verbal interactions. They dominated play sessions by dictating how or what to do (Madan-Swain & Zentall, 1990). Peers describe students with ADHD, in general, as noisy, bossy, bothersome, causing trouble, cruel to children, rude to teachers, and getting mad when they do not get their way (for review see Mrug, Hoza, & Gerdes, 2001). They are described by their teachers as less considerate, more hostile/aggressive, and more likely to end in fights and unpopularity than students with ADHD-I (Lahey & Carlson, 1991; Margalit & Almougy, 1991). The social function of this active/talkative and sometimes bossy and aggressive behavior could be explained by the goals of these children.

Psychological goals for children have been described as those directed toward getting competence, relatedness/participation, and self-determination (Deci & Ryan, 1985). To this set, we have added the biological needs for stimulation and the reciprocal needs to avoid experiences, persons, and tasks that are associated with failure/frustration, pain, boredom (e.g., get competence and avoid failure; get stimulation and avoid boredom) (Zentall & Javorsky, 1995; Zentall, 2006).

Of these goals, the social behavior of students with ADHD appears to be directed primarily toward obtaining social relatedness (see Table 1). For example, as early as 15 months, full-term infants (later identified in the fifth grade as ADHD) were observed to allocate a greater number of attentional episodes to persons than typical infants (Cherkes-Julkowski, 1998). Whalen (1989) similarly concluded that these children have an “apparently strong and enduring interest in being with other people” (p. 145). Social relatedness goals have been found in association with positive self- and other-perceptions (‘I’m OK and you’re OK’) and to instrumental behavior that is prosocial and high in initiation (Salmivalli, Ojanen, Haanpaa, & Peets, 2005).

Table 1
Differences in goals among ADHD subtypes

ADHD-H or ADHD-C	ADHD plus aggression	ADHD-I
Goals of getting stimulation through social interactions with others (Cherkes-Julkowski, 1998; Whalen, 1989; Zentall, Moon, Hall, & Grskovic, 2001; Zentall & Smith, 1992).	Goals of getting stimulation often through strong negative emotional reactions from others (Melnick & Hinshaw, 1996; Meyer & Zentall, 1995).	
Goals of social competence through competitiveness (Carlson et al., 2002).	Goals of social competence through competitiveness; few goals of being fair (Melnick & Hinshaw, 1996)	Goals of academic competence; few goals that involve competitiveness (Carlson et al., 2002).
Goals of self-determination (autonomy, control) (Madan-Swain & Zentall, 1990).	Goals of self-determination (power, dominance) (Madan-Swain & Zentall, 1990).	
Goals of fun and excitement that often involve stirring-up-trouble (Melnick & Hinshaw, 1996; Whalen, 2001).	Goals of fun and excitement that often involve getting-into-trouble (Melnick & Hinshaw, 1996).	

However, these social participation goals do not fully explain the negative, often aggressive quality of their behavior, especially for those children with the combined or hyperactive/impulsive subtypes. Aggression *can* function by producing strong social responses (emotional reactions) from others. DuPaul and Ervin (1996) concluded that a major function of the behavior of students with ADHD was to get adult and peer attention—negative or positive. Related evidence indicates that students with ADHD seek excitement and disruption in their social interactions (for data and review see Melnick & Hinshaw, 1996).

Alternatively, the aggression that is observed in social settings could function by achieving control (self-determination/autonomy to control/dominance/superiority) (Melnick & Hinshaw, 1996; Pintrich & Schunk, 1996). Social goals of power and influence are associated with positive self-perceptions (“I’m OK,” similar to the goals of social relatedness) but with negative perceptions of others (“I’m OK, but you’re not”), and these types of goals are found in association with aggressive behavior (Salmivalli et al., 2005).

Students with ADHD-H also have goals related to getting competence through competition. They rated themselves and were rated by their teachers and parents as competitive and ego-involved—with goals of competence and the social display of competence more than typical peers or IQ-matched children with ADHD-I (Carlson, Booth, Shin, & Canu, 2002). It is the social display of that competence that suggests that these children focus on ‘performance goals,’ rather than ‘mastery goals.’ Performance goals describe individuals who are motivated to present themselves in a positive light and as having superior skills and ability in comparison to others (Nicholls, 1984; Ohan & Johnston, 2002). These performance goals are especially problematic when children are placed in difficult academic situations. Under these conditions, children focus on avoiding incompetence (social failure), rather than getting competence, and in response to perceived threat, they are more likely to respond with negative affectivity (e.g., anxiety, depression, feelings of shame) or expressions of contempt/defiance (for review see Pisecco, Wristers, Swank, Silva, & Baker, 2001).

Performance goals related to social competence could also explain findings that boys with ADHD gave optimistic predictions about the amount that teachers liked them, whereas comparison boys were more accurate in their social appraisals (Ohan & Johnston, 2002). Initial optimistic responses or a ‘self-enhancing’ bias (“I’m OK”) appears to protect social image. That is, when students with ADHD received false but positive feedback about how much teachers liked them, they dropped their initial ‘public’ inflated estimates of their own likeability (Diener & Milich, 1997; Ohan & Johnston, 2002). In other words, these children attempted to hide deficits in social performance from others (e.g., by inflating their estimates of likeability); when there was no longer a threat of social failure, they could make socially accurate estimates.

Differently from boys, girls with ADHD do not differ from comparison girls in types of self-reported goals (i.e., all the girls selected participatory goals). However, there were differences between groups in the behavior selected to achieve those goals (i.e., Thurber, Heller, & Hinshaw, 2002). That is, girls with ADHD-I were more likely to select aggression as the appropriate response and were aware that peers would respond negatively to these choices, whereas comparisons more often selected negotiation to achieve the same goals and were aware that peers would respond positively. Girls with ADHD-C do use more overt aggression than girls with ADHD-I, who in turn use more than comparisons; peers similarly rated each group in this order in their expression of relational aggression

(Zalecki & Hinshaw, 2004). These findings remained even when group differences in verbal IQ were statistically controlled.

The behavior that both boys and girls select does produce asocial and antisocial responses from classmates. That is, peers: (a) retreat from aggression, ignoring, being less responsive to, less talkative, less positive in their play, and communicating less efficiently with their partners, and (b) increase their activity, off-task, negative, and commanding/controlling responses (Madan-Swain & Zentall, 1990; Fischer, Barkley, Edelbrock, & Smallish, 1990; Stormont-Spurgin & Zentall, 1995; Zentall, 2006).

Such changes in typical children probably make it more difficult for students with ADHD to maintain social interactions. For example, when falsely told that their work partner would be a child who talked when he was not supposed to, did not sit still, acted silly, and disrupted the class, typical children, especially younger children, were less likely to see positives in the actual task or social performance of their partners (i.e., than when peer partners had no expectations, Harris, Milich, & Johnston et al., 1990). Those average students who were falsely expected to show behavior similar to children with ADHD also found their peer task to be more difficult than typical children whose partners had no expectations.

An intense need for (a) social contact, (b) emotional responses from peers or control over peers, and (c) being viewed as socially competent and better than others (performance goals) coupled with the disappointment with their own social failures appear to change these children over time. That is, students with ADHD begin with high needs for social stimulation (relatedness or participation), however, by adolescence they reported more time spent alone, fewer interpersonal interactions, less confidence, and rated their peer, sibling, and adult relationships as negative and unsatisfactory (see Dumas, 1998; Waddell, 1984). In addition, thirty percent of the mothers of teen-agers with ADHD reported that their boys had no steady friends (Hechtman, Weiss, & Perlman 1980). When children with ADHD were also aggressive, about 60–76% of them had no friends in class (see Mrug et al., 2001). Both, medicated and non-medicated teens now described themselves by what they were not (“I’m not friendly” “I’m not smart”) (Waddell, 1984). These attributions are consistent with the self-perpetuating cycle demonstrated for children with performance goals, who explain their social outcomes in terms of their own unalterable abilities (e.g., “I’m not friendly”), and who view positive outcomes as unlikely and give up quickly when faced with new social tasks (see Pisecco, Wristers et al., 2001).

2. The inattentive subtype of ADHD and overlap with LD

2.1. Attentional style and social outcomes

Children identified as the pure inattentive subtype represent over a quarter of all students with ADHD and are similar in rated inattention to the combined subtype (ADHD-C who represent over half of students with ADHD; Wilens, Biederman, & Spencer, 2002). An externalizing behavioral style does not characterize children with ADHD-I; in fact, there is greater shyness and social withdrawal (for review see Morgan, Hynd, Riccio, & Hall, 1996). Teachers and parents also perceived the ADHD-I group (and LD group) as better able to inhibit responses and as exhibiting behavior that was less problematic and less likely to have a co-diagnosis of conduct disorder than the ADHD-H subtype (Lahey & Carlson, 1991; Warner-Rogers, Taylor, & Sandberg, 2000). Girls with

Table 2
Rates of co-occurring disorders in girls with ADHD

	Conduct (%)	Oppositional defiant (%)	Anxiety (%)	Depression (%)
Typical children	0	7	3	0
ADHD—inattentive	11	47	19	4
ADHD—combined	27	71	31	10

Data from Hinshaw (2002).

ADHD-I were still perceived by their peers to be more aggressive than comparison girls (Zalecki & Hinshaw, 2004), although they also had lower rates of co-occurring conduct and oppositional defiant disorders than girls with ADHD-C (see Table 2). What differentiates students with ADHD-I (and -C) from children with other mild disabilities is an attentional style that is defined by selective and sustained inattention.

2.1.1. Selective attentional bias

Students with ADHD-I (and -C) are more likely than their peers to pay attention to what is brighter, bigger, more intense, colorful, louder, or moving (Copeland & Wisniewski, 1981; Radosh & Gittelman, 1981; Zentall, 1989). That is, they self-generate stimulation through attraction to novelty (see Zentall & Zentall, 1983; Zentall, 2005, 2006, who extended the optimal stimulation theory to include sensory, cognitive, and emotional responses as alternative ways to generate stimulation). Because of this preference for stimulation, it would be difficult to selectively focus on relevant and neutral information, especially when it *overlaps* with more interesting information, such as external conversations or intruding thoughts (Cooley & Morris, 1990). Relevant information includes specific attributes of tasks or contexts (e.g., sequence, structure, organization). An optimal amount of physiological arousal is required to focus attention, ignore irrelevant information, and sustain attention over time (Cooley & Morris, 1990).

The attentional biases of students with ADHD-I (and -C) have social outcomes. Preferences for intense stimulation can reduce accuracy in reading internal feedback from the self (e.g., standards, thoughts, strategies, values, subtle feelings, experiential histories, intentions, expectations) (for review see Zentall, Hall, & Lee, 1998). A lack of awareness of their own feelings and intentions, could explain the tendency of the combined subtype to: (a) blame others for frustration and social failure (for review see Mrug et al., 2001) and use excuses, (b) feel disconnected from the outcomes of their behavior, and (c) rely on external cues and feedback (for review see Zentall, 2006).

Preferences for intense stimulation can also reduce accuracy in interpersonal contexts when ‘reading’ external information (e.g., teachers’ instructions, peers’ task-related conversations, social reactions). For example, when reading others, children with ADHD were less accurate than their peers when asked to match a brief story to pictures of facial emotional expressions (Singh et al., 1998). They were not biased in recognizing types of emotions, but their inconsistent pattern of errors represented a failure to consistently attend to social cues. In other words, their pattern of errors was similar to the pattern of average children and different from the anger-biased pattern of children with conduct problems (Cadesky, 2000; Singh et al., 1998).

Their pattern of reactions *can* be biased, however, when students with ADHD have negative models or a history of negative experiences. For example, boys, girls, and adults with ADHD report more negative events and failure in their lives, which were perceived by them as stable and global across settings (Hoza, Pelham, Milich, Pillow, & McBride, 1993; Rucklidge & Tannock, 2001; Vitaro, Tremblay, Gagnon, & Pelletier, 1994, Weiss & Hechtman, 1993). Furthermore, these children may more readily learn aggression if they attend to aggressive models and if the consequences for their aggressive behavior are loud and intense social responses (e.g., yelling), which reinforce them but not their peers (Meyer & Zentall, 1995).

A history of negative experiences may also play a role in the negative emotionality they report at higher rates than their classmates. That is, in addition to sadness, anger was experienced 40% of the time and anxiety about half the time (Whalen, 2001). This negative history may contribute to the greater likelihood that they (a) make negative (but not hostile) interpretations when social cues are unclear (Zentall, Javorsky, & Cassady, 2001) or (b) play more negatively with neutral toys than their classmates (Madan-Swain & Zentall, 1990). As well, when asked to predict social outcomes for a main character in stories with unclear social outcomes, children with ADHD predicted fewer positive outcomes about what would happen ‘next week’ than their peers (Zentall, Javorsky et al., 2001).

A history of negative experiences may also play a role in the emotional over-reactions of these children. Teachers and parents reported, and children with ADHD self-reported, that they over-reacted to the good and bad events in their daily lives (Abikoff et al., 2002; Eisenberg et al., 1997; Moon et al., 2001). For example, the highest score on parents’ ratings of their girls was found on a factor of girls’ unregulated emotions (moodiness, reactivity, Grskovic & Zentall, 2006). One item on a similar factor in girls’ self-rating (‘more likely than other girls to react with strong feelings’) stood alone in separating elementary-aged girls with ADHD from typical girls (Grskovic & Zentall, 2006). Adolescent girls with ADHD also self-reported that negative events had a greater effect on them than comparison girls, which was also greater than boys with ADHD (Rucklidge & Tannock, 2001). That is, girls with ADHD appear to be more sensitive/reactive to both positive and negative social feedback.

Similarly, the negative social experiences of students with LD (i.e., 75% of whom also experience social problems, Kavale & Forness, 1996) appear to contribute to their overreactions to everyday events. When responding to unfriendly contacts, children with LD, especially girls, were more likely to make negative self-judgments than were typical children, and in response to friendly contacts, they were also more likely to make positive self-judgments (Settle & Milich, 1999).

2.1.2. *Sustained inattention*

Preferences for intense stimulation can also produce a set of problems during later performance after adaptation to methods and materials. In particular, children with ADHD have difficulty sustaining attention to long, rote/repetitive, uninteresting, or non-active tasks and conversations. Thus, their attentional ‘deficit’ occurs when there is increased task length, familiarity, and repetitiveness.

Failure to sustain attention for preschoolers can be seen in the number of activity or toy changes (Dienske, de Jonge, & Sanders-Woudstra, 1985). In elementary school, children with ADHD continue to change their activities and topics of conversation

(and interrupt others) and move off-task behaviorally or visually more often than their peers during homework, schoolwork, and social tasks (for review see Zentall et al., 2006). At the secondary level, students are off-task visually, especially during academic tasks (e.g., Zentall, 1990), whereas adults with ADHD more than comparisons make changes of vocation and residence (Barkley, Fischer, Edelbrock, & Smallish, 1990; Hartsough & Lambert, 1982).

Differently, children with LD will have a harder time maintaining attention to those specific tasks and subject areas that have been difficult for them. Their greater initial effort leaves them less able to sustain effort. Children with reading disabilities do improve with age on tasks that require sustained attention (e.g., to sequential verbal stimuli or letters, Krupietz, 1990). In this study, fewer developmental improvements in sustained attention were documented only for students with reading disabilities and co-occurring ADHD. Although the ability to sustain attention improves with age for individuals with ADHD, they still lag behind their peers (e.g., more errors and variability) (Zentall, 2006).

Frequent changes in the focus of play, in directed thought, and in conversational topics (i.e., irrelevant and off-task comments) have social consequences. The relevance and coherence of what children say is decreased for students with ADHD who inappropriately order words and sentences (Oram, Fine, Okamoto, & Tannock, 1999; Purvis & Tannock, 1997). Especially when retelling complex stories (many characters and events), the language of students with ADHD was characterized by ambiguous references and more sequencing and cohesion errors than their peers (Tannock, Schachar, & Logan, 1993). These types of errors indicate a failure to hold information in mind while planning and organizing its expression, as well as, failure to self-monitor language and its intended social meaning.

There is also a failure to respond appropriately to social roles in conversation. That is, elementary- and middle-school boys with ADHD were less likely than comparisons to change their communication style when changing roles from speaking to listening and from interviewee to interviewer (Whalen, Henker, Collins, McAuliffe, & Vaux, 1979; Landau & Milich, 1988). For example, they asked more questions as an interviewee and fewer questions as an interviewer. These role reversal difficulties may be associated with the passive versus active nature of the conversational roles assigned. Students with ADHD differ from their peers more when listening than when attempting to send information to others (i.e., talking is more active than listening, Zentall & Gohs, 1984). Similarly, students with ADHD also had difficulty with a task only when they were assigned the less active helper role and not in the more active worker role (Grenell, Glass, & Katz, 1987).

2.2. Academic deficits, social goals, and outcomes

Selective and sustained inattention also contribute to academic outcomes for students with ADHD. There is evidence that as many as 80% of students with ADHD also had academic problems (Cantwell & Baker, 1991), for example, in mathematics, handwriting, reading comprehension, spelling, and non-verbal math concepts (even when controlling for IQ, McGee, Williams, & Silva, 1984; Zentall, 1989, 1993).

In contrast, academic deficits contribute to the attentional difficulties of students with LD. Students with LD are characterized by significant skill deficits demonstrated in a consistent pattern of errors in a specific academic domain (math or reading), or in a broad range of language functions (e.g., listening, speaking, reading, spelling, written language)

or non-verbal tasks, such as mathematics or social comprehension (McGee & Share, 1988). Skill difficulties make it more difficult to selectively attend and maintain attention to those specific areas.

The inattention that characterizes the combined and the inattentive subtypes of ADHD appears to be especially predictive of math calculation difficulties (Marshall, Hynd, Handwerk, & Hall, 1997; Marshall et al., 1999), even when controlling for IQ and slower motor responses (Zentall, 1990; Zentall & Smith, 1993; Zentall, Smith, Lee, & Wieczorek, 1994). There appears to be a continuum of difficulty, with students with LD and students with ADHD plus aggression demonstrating the most severe problems with timed addition facts, followed by pure ADHD groups and then by typical comparison students (MacLeod & Prior, 1996; for review see Zentall & Ferkis, 1993). About a quarter of students with math disabilities also have ADHD and these rates are higher for students with ADHD-I than for students with ADHD-H (Lindsay, Tomazic, Levine, & Accardo, 1999). Interestingly, math performance is used as a basis for self-judging intellectual ability (Stipek & MacIver, 1989).

Difficulties with story problems appears to be related to the greater attentional requirements of holding information in mind while reordering that information (working memory), especially when handling mixed actions, operations, order of operations, and sequences of steps (Zentall, 1990). Performance of multi-step problems was also the single strongest predictor of math achievement for students with math LD (Bryant, Bryant, & Hammill, 2000).

Whereas problems in working memory may characterize both groups, the underlying phonological difficulties that characterize reading disabilities (Stanovich, 1988) are not typically associated with ADHD (Shaywitz, Fletcher, & Shaywitz, 1994). Reading disabilities were associated with lower phonological sensitivity (more errors in sensitivity to rhyme and alliteration) (Ackerman, Dykman, & Gardner, 1990), difficulties with sound-symbol association, and deficits in short- and long-term memory on verbal tasks (Kaplan, Dewey, Crawford, & Fisher 1999; Korkman & Pesonen, 1994). In addition, students with reading disabilities (with and without ADHD) can have difficulty with the meaning (semantics) and grammar in spoken and written language (Purvis & Tannock, 1997).

While children with reading disabilities have poorer reading comprehension than listening comprehension, students with pure ADHD have the reverse pattern (for review see Aaron, Joshi, Palmer, Smith, & Kirby, 2002). This can be explained by evidence that students with pure ADHD have difficulties when there are requirements for sustained attention. For example, they fall behind in comprehension (but not in reading vocabulary), especially when passage lengths were increased (Cherkes-Julkowski & Stolzenberg, 1991). It is important to note that about 15% of children with ADHD achieve better in reading than predicted (i.e., reading scores greater than 1 standard deviation above age or IQ expectancy; Halperin, Gittelman, Klein, & Rudel, 1984).

Overall, children with inattention (ADHD-I and -C) demonstrate significant academic failure more often than the hyperactive impulsive subtype. For example, 72% of children with ADHD-I were retained in grade for one year, whereas only 17% of students with ADHD were similarly retained (Lahey, Applegate, & McBurnett, 1994), although the rates for girls is more evenly distributed (ADHD-I 20.5%; ADHD-C 14.1%; comparisons 3.4%, Hinshaw, 1992). Students with ADHD-I were more likely to have a co-occurring LD (Marshall et al., 1997). Those students with both ADHD and co-occurring reading disabilities have the receptive and expressive language problems of both disabilities

(Pisecco, Baker, Silva, & Brooke, 2001) but have more severe learning problems than children with only LD and more severe attention problems than those with only ADHD (Mayes et al., 2000). However, ADHD is not a LD (Geary, 1993; Lindsay, Tomazic, Levine, & Accardo, 1999; Mayes, Calhoun, & Crowell, 2000; Passolunghi & Siegel, 2004; Willcutt et al., 2001). That is, even though as many as 70% of clinic-referred samples of children with ADHD have co-occurring learning disabilities (Mayes et al., 2000), others report that only 30% of students fail to achieve to a level predicted by their IQ (for review see Barry, Lyman, Klinger, 2002).

Given the co-occurring learning disabilities and the specific academic problems (e.g., in math, handwriting) of students with identified ADHD, especially those with inattentive characteristics, it seems probable that failure would result in negative outcomes. Students with ADHD-I who experience academic failure may come to know that they are not OK. This may be indicated by their goals that are non-competitive and external (i.e., more motivated to please the teacher and make good grades than students with ADHD-H; Carlson et al., 2002).

More importantly, the way that children explain this failure to themselves can predict future goals and performance on new tasks and with new experiences (i.e., Dweck, 1986; Licht & Kistner, 1986). When children explain their academic failure in terms of unalterable factors, such as 'being stupid' (e.g., "I'm not smart"), they have lower expectations for future success and respond to failure with decreased effort (e.g., Licht & Dweck, 1984). Consistent with such interpretations, students with ADHD respond to academic failure with less effort and persistence. For example, boys with ADHD solved fewer puzzles, gave up more often, performed faster on the second puzzle, and reported more frustration than their peers (matched in age and IQ) (Milich, 1994; Milich & Okazaki, 1991). Children with ADHD (-C and -I) were reported by their teachers to show less enjoyment of learning, less persistence, and a greater reliance on external standards than comparisons (Carlson et al., 2002). Teacher and parent ratings also documented lower self-expectations and more discouragement in the learning context.

These responses to failure could be exacerbated by initially high estimates of future performance. That is, students with ADHD were more optimistic about future puzzle performance than their actual performance should have indicated, whereas comparison boys were more accurate in performing in line with realistic, high expectations (Ohan & Johnston, 2002). Similarly, students with LD over estimate their academic achievement in comparison to teacher ratings (for review see Meltzer, Katzir, Miller, Reddy, & Roditi, 2004).

3. Summary

The failure of children to meet the functional requirements of their school culture defines their disability. The inattentive subtype of ADHD (ADHD-I) and the hyperactive impulsive subtype (ADHD-H) are identified by failure to meet specific requirements of attending, sitting still, or getting along with others in classroom settings. LDs are defined by the cultural requirements of literacy (reading, math, writing) as these requirements are translated into today's classrooms. Thus, there are different setting requirements that define these groups, and it is by observing them under specific task and setting conditions that we come to understand these children.

Even when there are differences in the defining conditions, it can be especially difficult to separate ADHD-I from LD, because many of these children have both disabilities and each disability has attentional, academic, language, and social problems (Chhabildas et al., 2001; Willcutt & Pennington, 2000). Other commonalities between students with ADHD-I (and -C) and LD are in working memory, although what contributes to these deficits may differ between groups. Spoken and written language, reading, and math all require working memory to manipulate and organize letters, math steps/answers, and words/sentences (Hecht, Torgesen, Wagner, & Rashotte, 2000). Finally, the academic failure of both groups of students with ADHD-I and LD is also associated with social withdrawal and this withdrawal is associated with their social unpopularity.

Critical to differentiating students with ADHD (all subtypes) from students with LD is their response to stimulation. Students with ADHD have a primary goal of increasing stimulation, which students with LD do not have.

Children with ADHD—combined subtype (ADHD-C) use both behavioral and attentional means to self-generate stimulation. Children with the hyperactive/impulsive subtype (ADHD-H) attempt to get social stimulation (participation and/or emotional response) and social control and to be seen as competent by their peers. Perhaps because students with ADHD-H have fewer academic problems, they also had more socially competitive performance goals than students with ADHD-I. Students with ADHD-H (and -C) also have goals related to having fun and experiencing excitement (e.g., stirring-up-trouble) more than typical children. As an example, they reported more preferences for similar friends who were ‘fun-to-be-with’ and who caused trouble (Whalen, 2001). Their perceptions of social failure during adolescence may be secondary to strong early needs for social participation paired with a history of inadequate behavioral means to achieve this goal. In other words, early attempts to keep up social appearances of “I’m OK” may crumble during adolescence. Thus, spending more time alone may be a later outcome that is accompanied by a decreased willingness to face new interpersonal demands (see Dumas, 1998; Waddell, 1984).

Children with ADHD plus aggression also self-reported goals related to having fun, but they differed from children with low aggression by reporting fewer goals related to being fair and more goals of getting-into-trouble (Melnick & Hinshaw, 1996). Children who were higher in stimulus-seeking behavior engaged in more school misbehavior than their peers (Wasson, 1980).

Children with the inattentive subtype (ADHD-I) selectively attend to novelty (sensory, cognitive, emotional) as a way to optimize their state of activation. This attentional bias will make it more difficult for them than for their age-mates to locate what is important, especially when there are other irrelevant but attractive actions or features within new, complex, or unstructured academic and social tasks. It will also make it more difficult for them to attend to subtle feedback from others or to their own internally represented information (e.g., strategies, subtle feelings, goals). Children with ADHD-I suffer peer rejection even though they have few conduct problems (Dumas, 1998). Children with ADHD-I (and -C) also have difficulty sustaining attention to long, rote/repetitive, uninteresting, or non-active tasks or conversations. (In contrast, students with LD will have more problems with selective and sustained attention in their specific area(s) of LD.) The attentional and academic problems of students with ADHD-I (more than for ADHD-H) may contribute to their goals of achieving competence through non-competitive behavior and seeking approval from teachers (external standards).

For each of these groups there is a common response to failure that colors expectations about future outcomes. A history of unsuccessful academic or social experience appears to contribute to (a) increased sensitivity to everyday positive and negative social feedback, (b) increased intensity of emotional responses, and (c) decreased social participatory goals and prosocial behavior. Girls with LD and ADHD, more than boys, appear to overreact emotionally. This history of negative experiences also appears to increase children's reliance on external standards (performance goals) and avoidance of new or challenging tasks or social experiences. Avoidance goals are supported by private expectations of negative future outcomes, which can be found in students with LD and students with ADHD.

3.1. Educational implications

The educational implications of the learning and behavioral characteristics of these children can be found elsewhere (Zentall, 2006). The social implications of this article for students with ADHD appear to be related to their need for stimulation and its attainment through sensation-seeking, often disruptive and aggressive social responses. Students with ADHD-H (and -C) can be helped to find alternative ways to seek stimulation that do not solely rely only on one-on-one social interactions (e.g., through participation in clubs, sports, school activities, books, computers, pets, favorite objects). These activities need to be supported and not 'taken away' when the children fail to perform or behave as expected. They need more opportunities for social participation and will respond well to challenge, game-like learning, and public recognition of their performance (Carlson et al., 2002; Zentall, 2006).

Related to teaching them self-management, students with ADHD may need to identify and label their goals as a first step in negotiating their needs with others. Educators can help by asking questions (e.g., what do you think, feel, suggest, want) and by requiring journaling about thoughts, strategies, values, feelings, and expectations. Once students with ADHD can identify goals, they can be guided to influence and negotiate rather than control and to suggest, question, and provide examples rather than by directing or bossing others. They will need to assess whether their behavior is helping them achieve their identified goals. To do this, educators could ask children with ADHD whether a current behavior will, in the long run, bring them closer to participating with others and achieving the fun they desire. These students may see themselves as attempting to have fun even though others may interpret their behavior as disruptive. For this reason, it may be necessary to teach students to collect information on the reactions of their social partners or on the behavior of successful active students (i.e., to focus their attention selectively on neutral information and positive exemplars). In addition to finding alternatives, students with ADHD-H (and -C) will need a plan for maintaining good relationships (i.e., to see friendliness, fairness, and cooperation as valued areas of competence).

In contrast, students with ADHD-I and LD are directed toward goals of obtaining social approval often by conformity to adult academic standards. To build on this goal, educators could ask children with ADHD-I and LD how their avoidance of a new or difficult task will, in the long run, allow them to feel competent. It is equally important to balance this challenge by helping them recognize that the processes of effort and learning are more important in the long run than end products, such as grades. This will emphasize

mastery goals that are achieved by comparing an individual's past with present performance rather than in comparison with others (i.e., performance goals). Educators, in turn, must recognize the importance of their competencies and interests in areas related to academics, such as hobbies, collections, music, dance, drama, computer expertise, special content areas of interests. Providing a forum for the expression of these related skills in a non-competitive way (e.g., through cooperative learning) is an accommodation that educators can make (Carlson et al., 2002; Zentall, 2006).

To act as a counterweight to the negative self-statements that can typify both subtypes of adolescents ("I am not friendly" and "I am not smart"), it will be necessary to start early and remind young children of their successful experiences, positive traits, and social or academic improvements (verbally, with portfolios of good work, or with taped or written positive statements elicited from peers). Frequent positive feedback about small social successes could also help them become more realistic about their social interactions (Milich & Diener, 1995). This could allow students with ADHD to examine the actual quality of their social effort and its consequences without exaggerated expectations of bettering others and the resulting feelings of complete failure.

Although it is important for children to see that they are OK, so they are willing to initiate and persist with new academic and social experiences, it is equally important for students with ADHD and aggressive tendencies to see that others are OK. To this end they need to be reminded of past experiences when their immediate reactions to social feedback (positive or negative) were overreactions and their past negative interpretations were actually in response to neutral or ambiguous social events. With this reminder they could learn to wait a day and see how they feel before responding, to ask others what might have been intended, and to talk with others about alternative interpretations of their experiences. This may be especially important for girls with ADHD-C, who appear particularly sensitive and susceptible to peer rejection (Zalecki & Hinshaw, 2004; Diamantopoulou, Henricsson, & Rydell, 2005).

Overall, protecting students from their perception of failure relative to their primary goals could stop the cascading effects of emotional over-reactivity to feedback, aggression, negative expectations, social withdrawal, or decreased willingness to engage in new tasks or interpersonal experiences. When individuals expect negative outcomes, it may protect them from further disappointment, but it can also produce impairment by reducing effort, persistence, and the ability to recognize the good experiences and positive opportunities that are available.

References

- Aaron, P. G., Joshi, R. M., Palmer, H., Smith, N., & Kirby, E. (2002). Education module. *Journal of Learning Disabilities*, 35, 425–437.
- Abikoff, H. B., Jensen, P. S., Arnold, L. L. E., Hoza, B., Hechtman, L., Pollack, S., et al. (2002). Observed classroom behavior of children with ADHD: Relationship to gender and comorbidity. *Journal of Abnormal Child Psychology*, 30, 349–359.
- Ackerman, P. T., Dykman, R. A., & Gardner, M. Y. (1990). ADD students with and without dyslexia differ in sensitivity to rhyme and alliteration. *Journal of Learning Disabilities*, 23, 279–283.
- Allen, T. W. (1986). Styles of exploration in control, attention deficit disorder with hyperactive and learning disabled children. *Journal of Learning Disabilities*, 19, 351–353.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

- Barkley, R. A., Fischer, M., Edelbrock, C. S., & Smallish, L. (1990). The adolescent outcome of hyperactive children diagnosed by research criteria: I. An 8-year prospective follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 29, 546–557.
- Barry, T. D., Lyman, R. D., & Klinger, L. G. (2002). Academic underachievement and attention-deficit/hyperactivity disorder: The negative impact of symptom severity on school performance. *Journal of School Psychology*, 40, 259–283.
- Berlyne, D. E. (1960). *Conflict, arousal and curiosity*. New York: McGraw-Hill.
- Bryant, D. P., Bryant, B. R., & Hammill, D. D. (2000). Characteristics behaviors of students with LD who have teacher-identified math weaknesses. *Journal of Learning Disabilities*, 33, 168–177.
- Cadesky, E. B. (2000). Beyond words: How do children with ADHD and/or conduct problems process non-verbal information about affect? *Journal of the American Academy of Child and Adolescent Psychiatry*, 39, 1160–1167.
- Cantwell, D. P., & Baker, L. (1991). Association between attention deficit-hyperactivity disorder and learning disorders. *Journal of Learning Disabilities*, 24, 88–95.
- Carlson, C. L., Booth, J. E., Shin, M., & Canu, W. H. (2002). Parent-, teacher-, and self-rated motivational styles and ADHD subtypes. *Journal of Learning Disabilities*, 35, 104–113.
- Cherkes-Julkowski, M. (1998). Learning disability, attention deficit disorder, and language impairment as outcomes of prematurity: A longitudinal descriptive study. *Journal of Learning Disabilities*, 31, 294–306.
- Cherkes-Julkowski, M., & Stolzenberg, J. (1991). The learning disability of attention deficit disorder. *Learning Disabilities: A Multidisciplinary Journal*, 2, 8–15.
- Chhabildas, N. A., Pennington, B. F., & Willcutt, E. G. (2001). A comparison of the neuropsychological profiles of the DSM-IV subtypes of ADHD. *Journal of Abnormal Child Psychology*, 29, 529–540.
- Cooley, E. L., & Morris, R. D. (1990). Attention in children: A neuropsychologically based model of assessment. *Developmental Neuropsychology*, 6, 239–274.
- Copeland, A. P., & Wisniewski, N. M. (1981). Learning disability and hyperactivity: Deficits in selective attention. *Journal of Experimental Child Psychology*, 32, 88–101.
- Cunningham, C. E., & Siegal, L. S. (1987). Peer interactions of normal and attention-deficit disordered boys during free-play, cooperative task, and simulated classroom situations. *Journal of Abnormal Child Psychology*, 15, 247–268.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.
- Diamantopoulou, S., Henricsson, L., & Rydell, A.-M. (2005). ADHD symptoms and peers relations of children in a community sample: Examining associated problems, self-perceptions, and gender differences. *International Journal of Behavioral Development*, 29, 388–398.
- Diener, M. B., & Milich, R. (1997). The effects of positive feedback on social interactions in children with ADHD: A test of self-protective hypothesis. *Journal of Clinical Child Psychology*, 26, 256–263.
- Dienke, H., de Jonge, G., & Sanders-Woudstra, J. A. R. (1985). Quantitative criteria for attention and activity in child psychiatric patients. *Journal of Child Psychology and Psychiatry*, 26, 895–916.
- Dumas, M. C. (1998). The risk of social interaction problems among adolescents with ADHD. *Education and Treatment of Children*, 21, 447–460.
- DuPaul, G. J., & Ervin, R. A. (1996). Functional assessment of behavior related to attention-deficit/hyperactivity disorder: Linking assessment to intervention design. *Behavior Therapy*, 27, 601–622.
- Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, 41, 1040–1048.
- Eisenberg, N., Guthrie, I. K., Fabes, R. A., Reiser, M., Murphy, B. C., Holgren, R., et al. (1997). The relations of regulation and emotionality to resiliency and competent social functioning in elementary school children. *Child Development*, 68, 295–311.
- Fischer, M., Barkley, R. A., Edelbrock, C. S., & Smallish, L. (1990). The adolescent outcome of hyperactive children diagnosed by research criteria: II. Academic, attentional, and neuropsychological status. *Journal of Consulting and Clinical Psychology*, 58, 580–588.
- Geary, D. C. (1993). Mathematical disabilities: Cognitive, neuropsychological, and genetic components. *Psychological Bulletin*, 114, 345–362.
- Grenell, M. M., Glass, C. R., & Katz, K. S. (1987). Hyperactive children and peer interaction: Knowledge and performance of social skills. *Journal of Abnormal Child Psychology*, 15, 1–13.
- Grskovic, J., & Zentall, S. S. (2006). *The behavioral, social, and emotional characteristics and self-concepts of a school-based sample of girls with symptoms of ADHD*. Manuscript submitted for publication.

- Halperin, J. M., Gittelman, R., Klein, D. F., & Rudel, R. G. (1984). Reading-disabled hyperactive children: A distinct subgroup of attention deficit disorder with hyperactivity? *Journal of Abnormal Child Psychology*, *12*, 1–14.
- Harris, M. J., Milich, R., Johnston, E. M., et al. (1990). Effects of expectancies on childrens' social interactions. *Journal of Experimental Social Psychology*, *26*, 1–12.
- Hartsough, C. S., & Lambert, N. M. (1982). Some environmental and familial correlates of antecedents of hyperactivity. *American Journal of Orthopsychiatry*, *52*, 272–287.
- Hebb, D. O. (1955). Drives and the CNS (conceptual nervous system). *Psychological Review*, *62*, 234–254.
- Hecht, S. A., Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (2000). The relations between phonological processing abilities and emerging individual differences in mathematical computation skills: A longitudinal study from second to fifth grades. *Journal of Experimental Child Psychology*, *79*, 191–227.
- Hechtman, L., Weiss, G., & Perlman, T. (1980). Hyperactives as young adults. *Canadian Journal of Psychiatry*, *25*, 478–483.
- Hinshaw, S. P. (1992). Externalizing behavior problems and academic underachievement in childhood and adolescence: Causal relationships and underlying mechanisms. *Psychological Bulletin*, *111*, 127–155.
- Hinshaw, S. P. (2002). Presadolescent girls with attention-deficit/hyperactivity disorder: I. Background characteristics, comorbidity, cognitive and social functioning, and parenting practices. *Journal of Consulting and Clinical Psychology*, *70*, 1086–1098.
- Hoza, B., Pelham, W. E., Milich, R., Pillow, D., & McBride, K. (1993). The self-perceptions and attributions of attention deficit hyperactivity disorder and nonreferred boys. *Journal of Abnormal Child Psychology*, *21*, 271–286.
- Hubbard, J. A., & Newcomb, A. F. (1991). Initial dyadic peer interaction of attention deficit-hyperactivity disorder and normal boys. *Journal of Abnormal Child Psychology*, *19*, 179–195.
- Kaplan, B. J., Dewey, D., Crawford, S. G., & Fisher, G. C. (1999). Deficits in long-term memory are not characteristic of ADHD. *Journal of Clinical and Experimental Neuropsychology*, *20*, 518–528.
- Kavale, K. A., & Forness, S. R. (1996). Social skill deficits and learning disabilities: A meta-analysis. *Journal of Learning Disabilities*, *29*, 226–237.
- Korkman, M., & Pesonen, A. E. (1994). A comparison of neuropsychological test profiles of children with attention deficit-hyperactivity disorder and/or learning disorder. *Journal of Learning Disabilities*, *27*, 383–392.
- Krupietz, S. S. (1990). Sustained attention in normal and reading-disabled youngsters with and without ADDH. *Journal of Abnormal Child Psychology*, *18*, 357–372.
- Lahey, B., Applegate, B., & McBurnett, K. E. (1994). DSM-IV field trials for attention deficit hyperactivity disorder in children and adolescents. *American Journal of Psychiatry*, *151*, 1673–1685.
- Lahey, B. B., & Carlson, C. L. (1991). Validity of the diagnostic category of attention deficit disorder without hyperactivity: A review of the literature. *Journal of Learning Disabilities*, *24*, 110–120.
- Landau, S., & Milich, R. (1988). Social communication patterns of attention-deficit-disordered boys. *Journal of Abnormal Child Psychology*, *16*, 69–81.
- Leuba, C. (1955). Toward some integration of learning theories: The concept of optimal stimulation. *Psychological Reports*, *1*, 27–33.
- Licht, B. G., & Dweck, C. S. (1984). Determinant of academic-achievement—The interaction of childrens' achievement orientations with skill area. *Developmental Psychology*, *20*, 628–636.
- Licht, B., & Kistner, J. A. (1986). Motivational problems of learning-disabled children: Individual differences and their implications for treatment. In J. K. Torgesen, & B. Y. L. Wong (Eds.), *Psychological and educational perspectives on learning disabilities* (pp. 225–255). San Diego: Academic Press.
- Lindsay, R. L., Tomazic, T., Levine, M. D., & Accardo, P. J. (1999). Impact of attentional dysfunction in dyscalculia. *Developmental Medicine and Child Neurology*, *41*, 639–642.
- MacLeod, D., & Prior, M. (1996). Attention deficits in adolescents with ADHD and other clinical groups. *Child Neuropsychology*, *2*, 1–10.
- Madan-Swain, A., & Zentall, S. S. (1990). Behavioral comparisons of liked and disliked hyperactive children in play contexts and the behavioral accommodations by their classmates. *Journal of Consulting and Clinical Psychology*, *58*, 197–209.
- Margalit, M., & Almougy, K. (1991). Classroom behavior and family climate in students with learning disabilities and hyperactive behavior. *Journal of Learning Disabilities*, *24*, 406–412.
- Marshall, R. M., Hynd, G. W., Handwerk, M. J., & Hall, J. (1997). Academic underachievement in ADHD subtypes. *Journal of Learning Disabilities*, *30*, 635–642.

- Marshall, R. M., Schafer, V. A., O'Donnell, L., Elliott, J., & Handwerk, M. J. (1999). Arithmetic disabilities and ADD subtypes: Implications for DSM-IV. *Journal of Learning Disabilities*, 32, 239–247.
- Mayes, S. W., Calhoun, S. L., & Crowell, E. W. (2000). Learning disabilities and ADHD: Overlapping spectrum disorders. *Journal of Learning Disabilities*, 33, 417–424.
- McGee, R., & Share, D. L. (1988). Attention deficit disorder-hyperactivity and academic failure: Which comes first and what should be treated? *Journal of the American Academy of Child Adolescent Psychiatry*, 27, 318–325.
- McGee, R., Williams, S., & Silva, P. A. (1984). Behavioral and developmental characteristics of aggressive hyperactive and aggressive-hyperactive boys. *Journal of the American Academy of Child Psychiatry*, 23, 270–279.
- Melnick, S. M., & Hinshaw, S. P. (1996). What they want and what they get: The social goals of boys with ADHD and comparison boys. *Journal of Abnormal Child Psychology*, 24, 169–185.
- Meltzer, L., Katzir, T., Miller, L., Reddy, R., & Roditi, B. (2004). Academic self-perceptions, effort, and strategy use in students with learning disabilities: Changes over time. *Learning Disabilities Research and Practice*, 19, 99–108.
- Meyer, M. J., & Zentall, S. S. (1995). Influence of loud behavioral consequences on attention deficit hyperactivity disorder. *Behavior Therapy*, 26, 351–370.
- Milich, R. (1994). The response of children with ADHD to failure: If at first you don't succeed, do you try, try again? *School Psychology Review*, 23, 11–28.
- Milich, R., & Diener, M. B. (1995). The self-perceptions of children with ADHD: A paradox resolved? *The ADHD Report*, 3(5), 1–3.
- Milich, R., & Okazaki, M. (1991). An examination of learned helplessness among attention-deficit hyperactivity disordered boys. *Journal of Abnormal Child Psychology*, 19, 607–623.
- Moon, S., Zentall, S. S., Grskovic, J., Hall, A. M., & Stormont, M. (2001). Social and family characteristics of boys with giftedness and/or attention deficit/hyperactivity disorder. *Journal for the Education of the Gifted*, 24, 207–247.
- Morgan, A., Hynd, G., Riccio, C., & Hall, J. (1996). Validity of DSM-IV ADHD predominantly inattentive and combined types: Relationship to previous DSM diagnoses/subtype differences. *Journal of the American Academy of Child and Adolescent Psychiatry*, 35, 325–333.
- Mrug, S., Hoza, B., & Gerdes, A. C. (2001). Children with attention-deficit/hyperactivity disorder: Peer relationships and peer-oriented environments. *New Directions for Child and Adolescent Development*, 91, 51–76.
- Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review*, 91, 328–346.
- Ohan, J. L., & Johnston, C. (2002). Are the performance overestimates given by boys with ADHD self-protective? *Journal of Clinical Child Psychology*, 31, 230–241.
- Oram, J., Fine, J., Okamoto, C., & Tannock, R. (1999). Assessing the language of children with attention deficit hyperactivity disorder. *American Journal of Speech-Language Pathology*, 8, 72–80.
- Passolunghi, M. C., & Siegel, L. S. (2004). Working memory and access to numerical information in children with disability in mathematics. *Journal of Experimental Child Psychology*, 88, 348–367.
- Pennington, B. F. (1991). *Diagnostic learning disorders: A neuropsychological framework*. New York: Guilford Press (pp. 3–31).
- Pennington, B. F., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of Child Psychology and Psychiatry*, 37, 51–87.
- Pisecco, S., Baker, D. B., Silva, P. A., & Brooke, M. (2001). Boys with reading disabilities and/or ADHD: Distinctions in early childhood. *Journal of Learning Disabilities*, 34, 98–106.
- Pisecco, S., Wristers, K., Swank, P., Silva, P. A., & Baker, D. B. (2001). The effect of academic self-concept on ADHD and antisocial behaviors in early adolescence. *Journal of Learning Disabilities*, 34, 450–461.
- Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education*. Englewood Cliffs: Merrill Prentice Hall.
- Purvis, K. L., & Tannock, R. (1997). Language abilities in children with attention deficit hyperactivity disorder, reading disabilities, and normal controls. *Journal of Abnormal Child Psychology*, 25, 133–145.
- Radosh, A., & Gittelman, R. (1981). The effect of appealing distractors on the performance of hyperactive children. *Journal of Abnormal Child Psychology*, 9, 179–189.
- Rucklidge, J. J., & Tannock, R. (2001). Psychiatric, psychosocial, and cognitive functioning of female adolescents with ADHD. *Journal of the American Academy of Child and Adolescent Psychiatry*, 40, 530–540.

- Salmivalli, C., Ojanen, T., Haanpaa, J., & Peets, K. (2005). "I'm OK but you're not" and other peer-relational schemas: Explaining individual differences in children's social goals. *Developmental Psychology*, 41, 363–375.
- Satterfield, J. H., Schell, A. M., Nicholas, T. W., Satterfield, B. T., & Freese, T. E. (1990). Ontogeny of selective attention effects on event-related potentials in attention-deficit hyperactivity disorder and normal boys. *Biological Psychiatry*, 28, 879–903.
- Settle, S. A., & Milich, R. (1999). Social persistence following failure in boys and girls with LD. *Journal of Learning Disabilities*, 32, 201–212.
- Shaywitz, S. E., Fletcher, J. M., & Shaywitz, B. A. (1994). Issues in the definition and classification of attention deficit disorder. *Special issue: ADD and its relationship to spoken and written language. Topics in Language disorders*, 14, 1–25.
- Shaywitz, S. E., & Shaywitz, B. A. (1991). Introduction to the special series on attention deficit disorder. *Journal of Learning Disabilities*, 24(2), 68.
- Singh, S. D., Ellis, C. R., Winston, A. S., Singh, N. N., Leung, J. P., & Oswald, D. P. (1998). Recognition of facial expressions of emotion by children with attention-deficit hyperactivity disorder. *Behavior Modification*, 22, 128–142.
- Stanovich, K. (1988). The right and wrong places to look for the cognitive locus of reading disability. *Annals of Dyslexia*, 38, 157–177.
- Stipek, D., & MacIver, D. (1989). Developmental changes in children's assessment of intellectual competence. *Child Development*, 60, 521–538.
- Stormont-Spurgin, M., & Zentall, S. S. (1995). Contributing factors in the manifestation of aggression in preschoolers with hyperactivity. *Journal of Child Psychology and Psychiatry*, 36, 491–509.
- Tannock, R., Schachar, R. J., & Logan, G. D. (1993). Does methylphenidate induce overfocusing in hyperactive children? *Journal of Clinical Child Psychology*, 22, 28–41.
- Thurber, J. R., Heller, T. L., & Hinshaw, S. P. (2002). The social behaviors and peer expectations of girls with attention deficit hyperactivity disorder and comparison girls. *Journal of Clinical Child and Adolescent Psychology*, 31, 443–452.
- Vitaro, F., Tremblay, R. E., Gagnon, C., & Pelletier, D. (1994). Predictive accuracy of behavioral and sociometric assessments of high-risk kindergarten children. *Journal of Clinical Child Psychology*, 23, 272–282.
- Waddell, K. J. (1984). The self-concept and social adaptation of hyperactive children in adolescence. *Journal of Clinical Child Psychology*, 13, 50–55.
- Warner-Rogers, J., Taylor, A., Taylor, E., & Sandberg, S. (2000). Inattentive behavior in childhood. *Journal of Learning Disabilities*, 33, 520–537.
- Wasson, A. S. (1980). Stimulus-seeking, perceived school environment, and school misbehavior. *Adolescence*, 15, 603–607.
- Weiss, G., & Hechtman, L. T., (1993). *Hyperactive children grown up*, 2nd ed. Guilford, New York.
- Whalen, C. K. (1989). Attention deficit and hyperactivity disorders. In T. H. Ollendick, & M. Hersen (Eds.), *Handbook of child psychopathology* (2nd ed, pp. 131–169). New York: Plenum Press.
- Whalen, C. K. (2001). ADHD treatment in the 21st century: Pushing the envelope. *Journal of Clinical Child Psychology*, 30, 136–140.
- Whalen, C. K., Henker, B., Collins, B. E., McAuliffe, S., & Vaux, A. (1979). Peer interaction in a structured communication task: Comparisons of normal and hyperactive boys and of methylphenidate (ritalin) and placebo effects. *Child Development*, 50, 388–401.
- Wilens, T. E., Biederman, J., & Spencer, T. J. (2002). Attention deficit/hyperactivity disorder across the lifespan. *Annual Review of Medicine*, 53, 113–131.
- Willcutt, E. G., & Pennington, B. F. (2000). Comorbidity of reading disability and attention-deficit/hyperactivity disorder: Differences by gender and subtype. *Journal of Learning disabilities*, 33, 179–191.
- Willcutt, E. G., Pennington, B. F., Boada, R., Ogline, J. S., Tunich, R. A., Chhabildas, N. A., et al. (2001). A comparison of the cognitive deficits in reading disability and attention-deficit/hyperactivity disorder. *Journal of Abnormal Psychology*, 110, 157–172.
- Zalecki, C. A., & Hinshaw, S. P. (2004). Overt and relational aggression in girls with attention deficit hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology*, 33, 125–137.
- Zentall, S. S. (1975). Optimal stimulation as theoretical basis of hyperactivity. *American Journal of Orthopsychiatry*, 45, 549–563.
- Zentall, S. S. (1989). Attentional cuing in spelling tasks for hyperactive and comparison regular classroom children. *Journal of Special Education*, 23, 83–93.

- Zentall, S. S. (1990). Fact-retrieval automatization and math problem solving by learning disabled, attention-disordered, and normal adolescents. *Journal of Educational Psychology*, 82, 856–865.
- Zentall, S. S. (1993). Research on the educational implications of attention deficit hyperactivity disorder. *Exceptional Children*, 60, 143–153.
- Zentall, S. S. (2005). Theory- and evidence-based strategies for children with attentional problems. *Psychology in the Schools*, 42, 821–836.
- Zentall, S.S., (2006). *ADHD and education: Foundations, characteristics, methods, and collaboration*. Merrill/Prentice-Hall: Columbus, OH.
- Zentall, S. S., & Ferkis, M. A. (1993). Mathematical problem-solving for ADHD children with and without learning disabilities. *Learning Disability Quarterly*, 16, 6–18.
- Zentall, S. S., & Gohs, D. E. (1984). Hyperactive and comparison children's response to detailed vs. global cues in communication tasks. *Learning Disability Quarterly*, 7, 77–87.
- Zentall, S. S., Hall, A. M., & Lee, D. L. (1998). Attentional focus of students with hyperactivity during a word-search task. *Journal of Abnormal Child Psychology*, 26, 335–343.
- Zentall, S. S., & Javorsky, J. (1995). Functional and clinical assessment of ADHD: Implications of DSM-IV in the schools. *Journal of Psychoeducational Assessment, ADHD Special Monograph*, 22–41.
- Zentall, S. S., Javorsky, J., & Cassady, J. C. (2001). Social comprehension of children with hyperactivity. *Journal of Attention Disorders*, 5, 11–24.
- Zentall, S. S., Kuester, D. A., & Craig, B., (2006). *Students with and without ADHD during cooperative tasks*. Manuscript submitted for publication.
- Zentall, S. S., Moon, S. M., Hall, A. M., & Grskovic, J. A. (2001). Learning and motivational characteristics of boys with ADHD and or giftedness. *Exceptional Children*, 67, 499–519.
- Zentall, S. S., & Smith, Y. N. (1992). Assessment and validation of the learning and behavioral style preferences of hyperactive and comparison children. *Learning and Individual Differences*, 4, 25–41.
- Zentall, S. S., & Smith, Y. N. (1993). Mathematical performance and behavior of children with hyperactivity with and without coexisting aggression. *Behavior Research and Therapy*, 31, 701–710.
- Zentall, S. S., Smith, Y. N., Lee, Y. B., & Wiczorek, C. (1994). Mathematical outcomes of attention-deficit hyperactivity disorder. *Journal of Learning Disabilities*, 27, 510–519.
- Zentall, S. S., & Zentall, T. R. (1983). Optimal stimulation: A model of disordered activity and performance in normal and deviant children. *Psychological Bulletin*, 94, 446–471.