Utility of the PASS Theory and Cognitive Assessment System for Dutch Children With and Without ADHD

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Abstract

This study examined the utility of the Planning, Attention, Simultaneous, Successive (PASS) theory of intelligence as measured by the *Cognitive Assessment System* (CAS) for evaluation of children with attention-deficit/hyperactivity disorder (ADHD). The CAS scores of 51 Dutch children without ADHD were compared to the scores of a group of 20 Dutch children with ADHD. The scores of the Dutch children were also compared to American standardization samples of children with and without ADHD. The findings showed that children with ADHD in both countries demonstrated relatively low scores on the Planning and Attention scales of the CAS, but average scores on the Simultaneous and Successive scales. These findings are similar to previously published research suggesting that the PASS theory, as operationalized by the CAS, has sensitivity to the cognitive processing difficulties found in some children with ADHD.

The effects of attention-deficit/hyperactivity disorder (ADHD) are substantial and well documented (Barkley, 1990), making the topic one of the most widely researched areas in child, adolescent, and (increasingly) adult psychology (Goldstein & Ellison, 2002). Mannuzza and Klein (1999) concluded that children with ADHD fare worse in a variety of domains at school (e.g., lower grades, more failures) and have difficulty with cognitive functions, self-control, and self-esteem. Problems arising from ADHD have led this disorder to be the largest single source of referrals in mental health, educational, and medical settings (Barkley, 1981; Garland et al., 2001). Barkley (1981, 1990) estimated that children with ADHD constituted as much as 50% of referrals to child guidance clinics. The frequency of these referrals and the complexity of ADHD place considerable demands on those who attempt to make the diagnosis.

Clinicians who are faced with the task of diagnosing ADHD typically follow the guidelines provided by the *Diagnostic and Statistical Manual of Mental Disorders,* fourth edition (*DSM-IV*; American Psychiatric Association, 1994) and in so doing obtain information from parent and teacher questionnaires reported to be sensitive and specific to ADHD and from an in-depth history of the child. This may involve a clinical assessment as brief as an interview or as thorough as a full psychological evaluation. Beyond the criteria included in the *DSM-IV* (American Psychiatric Association, 1994), however, there continues to be little consensus about the exact combination of methods and tests that can be used to supplement the diagnostic interviews. Intelligence tests (e.g., the *Wechsler Intelligence Scale for Children–III;* WISC-III) that are thought to assess the cognitive component of ADHD have been used, and recently, the Planning, Attention, Simultaneous, and Successive (PASS) theory, as operationalized by the *Cognitive Assessment System* (CAS; Naglieri & Das, 1997), has been applied.

Paolitto (2000) compared children with ADHD to children without ADHD and found that the children with ADHD earned significantly lower scores on the CAS Planning scale than the matched control group. Naglieri, Goldstein, Iseman, and Schwebach (2003) also found that groups of children who met diagnostic criteria for ADHD earned significantly lower mean scores on the Planning scale of the CAS. Naglieri et al. (2003) also found that children with ADHD had a different PASS profile than children with anxiety disorders. These results supported the view of Barkley (1997, 1998a, 1998b) that ADHD involves problems with behavioral inhibition and self-control, which is associated with poor executive control (e.g., planning). These results may seem counterintuitive because ADHD is thought to be a failure of *attention,* but instead, as Barkley and others have suggested, many children with ADHD evidence a failure of regulation and self-monitoring, described by Naglieri and Das (1997) as *planning processing*. Children with

ADHD show deficits in the ability to stop, think, and plan before acting. Sandberg, Day, and Trott (1996) pointed out that ADHD is mainly caused by cognitive deficits in controlling the processes of self-regulation and inhibition. Children with ADHD also differ from typical children in their selection of responses and their ability to suppress or postpone a response (Van der Meere, 1996). The demands of these activities are consistent with the definition of planning as described by Naglieri and Das (1997).

The utility of PASS cognitive processing for the assessment of the cognitive deficits associated with ADHD has been suggested for samples of children in the United States (Naglieri et al., 2003; Paolitto, 2000), but no research has yet been reported for children in other countries. The purpose of this study was to examine the possible utility of the PASS theory, as measured using the CAS, for use with children with ADHD who reside in the Netherlands. To address this topic, Dutch children with ADHD were compared to other Dutch children without ADHD. Dutch children were also compared to the U.S. standardization sample of the CAS. Finally, Dutch children with ADHD and U.S. children with ADHD were compared.

Method

Participants

The Dutch translation and adaptation of the CAS (Van Luit, Kroesbergen, Van der Ben, & Leuven, 1998) was administered to two groups of children. The first group included a random sample of typical children who had not experienced learning problems ($n = 51$) and ranged in age from 9 to 12 years. These children attended Grades 4 to 6 in three schools for primary general education. These schools were randomly selected from middle class schools in the Netherlands, and the students were randomly selected within the schools. A second group included children with ADHD ($n = 20$), also from Grades 4, 5, and 6, who attended three randomly selected schools for elementary special education. In the Netherlands, children with ADHD and learning disabilities attend separate schools for children who require special education (Kroesberger, Van Luit & Naglieri, 2003). Children were selected from these schools if they were diagnosed as having ADHD by a psychiatrist who was not involved in the research project. The *DSM-IV* criteria were used to make the diagnosis based on the examination of school performance, teacher interviews, and the exclusion of other diagnoses, such as specific learning disabilities or mental retardation. Table 1 provides demographic information about the sample. Although the groups are similar by age, as is typically found, the ADHD group contained only boys. All these children individually completed the Dutch version of the CAS following precisely the methods described in the manual.

Instrument

The CAS consists of four scales, which each measure one of the PASS processes. Each scale consists of three subtests. The raw scores of the subtests are transformed into standard scores with a mean of 10 and *SD* of 3. Full Scale scores are derived from the sum of the subtest scores transformed to standardized scores with a mean of 100 and *SD* of 15. The American version is standardized on the scores of 2,200 children ages 5 through 17 years. The CAS Full Scale has high internal reliability, ranging from .95 to .97 for the different age groups. The average reliability coefficients for the scales are .88 (Planning), .88 (Attention), .93 (Simultaneous Processing), and .93 (Successive Processing). Evidence for the validity of the CAS has been summarized by Naglieri and Das (1997), Naglieri (1999), and Naglieri (2003). These summaries suggest that the PASS theory of intelligence, as operationalized by the CAS, offers a viable alternative to traditional IQ for at least four reasons. First, children's PASS profiles are relevant to differential diagnosis and especially helpful for children with learning disabilities and attention deficits (e.g., Naglieri et al., 2003). Second, the CAS is an excellent predictor of achievement, despite the fact that it does not contain verbal and achievement-based tests like those found in traditional measures of IQ (see also Naglieri & Rojahn, 2004). Third, the PASS theory provides information that is relevant to intervention and instructional planning (see also Naglieri & Pickering, 2003). Fourth, the CAS is well suited for culturally diverse populations (Naglieri, 2003). For these reasons, the CAS was considered a potentially useful instrument in the Netherlands.

The Dutch translation and adaptation of the CAS (Van Luit et al., 1998) was developed following a comprehensive cross-cultural adaptation approach that was implemented by a research team at Utrecht University. The method considered several important dimensions of the instructions (i.e., semantic, technical, content, criterion, and conceptual dimensions). For example, after the initial translation was

TABLE 1
Description of the Dutch Samples

	Age in years		Gender		School	
Group	*M*	*SD*	Boys	Girls	GE	SE
ADHD	10.6	0.9	20	0	2	18
Control	11.1	1.0	27	24	51	0

Note. ADHD = attention-deficit/hyperactivity disorder; GE = general education; SE = special education.

completed, it was back-translated. There were some minor problems with the understanding of the translation in 2 subtests (out of 12). After a revision, we tested the version using a representative sample of 20 children in the same age range as in this study and found that there were no misunderstandings of the directions. The reliability and validity testing represented in this research study were used to evaluate the utility of this adapted version of the CAS. The resulting subtests used to assess the PASS constructs are described in the following sections.

Planning. Planning is a mental process in which the child takes decisions, selects strategies and uses them, and evaluates solutions for problems. Planning is important for solving problems, both simple and complex ones. For their solution, attention, simultaneous, and successive processes can be necessary. The three subtests that measure Planning are relatively easy but allow the child to use the most efficient solution method. Planning subtests are best completed using strategies that are also observed during administration. In the Matching Numbers subtest, the children have to find two numbers that are the same in each of eight rows on a page. The length of these numbers ranges from single-digit numbers to eight digits. The Planned Codes subtest consists of two pages with letters (A, B, C, D) with an empty space under each letter, where the child must fill in a given code; each letter has its own code. On the first page, the letters appear in columns (in the first column the A's, in the second the B's, etc.); on the second page, the letters appear in a diagonal pattern. The child uses a strategy to complete the page. The Planned Connections subtest consists of eight items that increase in difficulty. Each item contains a page with scattered numbers or letters on it. The child is expected to connect the letters and numbers with each other in the right order.

Attention. Attention is a mental process by which the individual has to focus on specific stimuli while there are also other, less relevant stimuli present. A good score on the Attention subtests means that the attention is directed, selective, and persistent. The subtests always require a decision about reacting or not reacting to specific stimuli in a complex environment. The Expressive Attention subtest measures the selectivity and the ability to divide attention. The subtest for older children (8–17 years) is comparable to the Stroop test (Stroop, 1935); for the younger children (5–7 years), an analogous version is made with pictures of animals. The child has to suppress a logical (automatized) answer to be able to give the right answer. The Number Detection subtest measures selectivity, the division of attention, and the ability to resist distraction. Every item consists of rows of numbers. The child is asked to underline the numbers that look the same as the ones that are listed in an example without skipping around the page; for example, the number 3 when it appears in bold type (e.g., **3**), but not when it appears in normal type (e.g., 3). The Receptive Attention subtest consists of pictures or letters (depending on the age of the child) that are presented in pairs. When the two pictures or letters are the same or have a specific consistent feature, the child has to underline them, otherwise not.

Simultaneous Processing. Simultaneous processing is a mental process by which the child integrates several different stimuli into a whole. The essence of simultaneous processing is that a person has to make connections between the elements of the stimuli, by which they become a perceptual or conceptual whole. The Simultaneous Processing scale includes nonverbal spatial as well as verbal logical–grammatical components. The Nonverbal Matrices subtest uses geometrical shapes in a logical relation from which a piece is missing, as in standard progressive matrices. The child has to choose the right answer out of six possible answers. The Verbal–Spatial Relations subtest requires the comprehension of logical and grammatical descriptions of spatial relations. Each page shows six pictures with a corresponding question that is read aloud by the examiner. The child has to choose the picture that fits the verbal description. In the Figure Memory subtest, a page with a two- or three-dimensional figure is shown for 5 seconds. Subsequently, the child has to find the original figure when it is presented embedded within a larger, more complex geometric pattern.

Successive Processing. Successive processing is a mental process by which the child integrates stimuli in a specific order. Successive processing is necessary when a child has to remember or use information that follows in a strict, defined order, especially serial and syntactical information. The Word Series subtest is a verbal subtest that consists of repeating a series of one-syllable words, increasing from two to nine words per series. The Sentence Repetition subtest is also a verbal subtest, in which the child has to repeat nonsense sentences (sentences in which all verbs and nouns are replaced by colors, like "The yellow greened the blue."). The successful completion of this task requires conception of the syntax of the sentence. The Speech Rate subtest is a verbal subtest for children from 5 to 7 years. The test consists of eight items of one- and two-syllable words that have to be repeated 10 times. The score is the time it takes the child to complete each item. The Sentence Questions subtest is a verbal subtest for children from 8 to 17 years. In this subtest, the same types of sentences are used as in Sentence Repetition, but in this subtest, a question is asked, for example, "The red blued with green. What did the red do?" Comprehension of the sentence based on the ordering of the words is required to answer the question correctly.

Results

Dutch children without detected learning or behavior problems earned scores that were similar to the norma-

tive values obtained for the U.S. standardization sample (see Figure 1). The mean scores ranged from 95.6 (Planning) to 103.0 (Successive), and the CAS Full Scale score was 100.39 (see Table 2). The differences between the values earned by the Dutch children were compared to the U.S. normative means using one-sample *t* tests with the Bonferroni correction. Values for the *t* test that were significant at $p = .003$ were considered significant at an overall error rate of $p < .05$. It can be concluded that the CAS subtest scores do not differ from the U.S. norms. The Dutch children scored lower on two of the three Planning subtests, namely, Planned Codes, $t(50) = -5.182$, $p = .001$, and Planned Connections, $t(50) = -3.626$, $p =. 001$. The Dutch children, however, scored higher than the American population on two other subtests, Figure Memory, $t(50) = 3.492$, $p = .001$, and Sentence Repetition, $t(50) = 3.114$, $p = .003$. The differences were about one third of a standard deviation.

The means and *SD*s obtained by the Dutch children with ADHD and the Dutch control group are also provided in Table 2. The *d* ratios provided in this table suggest that the samples differed in important ways. First, the Planning scores for the Dutch children with ADHD differed from the Dutch control group substantially ($d = 1.3$) and significantly, $F(1, 69) = 26.699$, $p < .003$. Second, the two groups also differed substantially ($d = 1.3$) and significantly, $F(1, 69) = 24.926$, $p < .003$, on the Attention scale. In contrast, the differences between these groups were considerably less on the Simultaneous, $d = 0.46$, $F(1, 69) = 3.009$, $p > .05$, and Successive scales, $d = 0.46$, $F(1, 69) = 7.250$, $p > .05$. There were no significant Simultaneous or Successive subtest differences between the groups. Secondary analyses with only boys—to control for gender differences between the ADHD and control groups—showed comparable results. The boys in the Dutch control group earned mean scores of 96.3, 101.6, 100.6, 103.3, and 100.3, respectively, on the Planning, Attention, Simultaneous, Successive, and Full Scales, which were very similar to the scores earned by the total Dutch control group. Moreover, the mean scores between the male-only Dutch control group and the Dutch group with ADHD differed substantially for Planning ($d = 1.64$) and Attention ($d = 1.34$), whereas considerably smaller differences were found on the Simultaneous ($d = 0.41$) and Successive scales ($d = 0.70$).

Discussion

The purpose of this study was to begin an examination of the performance of Dutch children on a Dutch version of the CAS and to examine the performance of Dutch children with ADHD on the processes included in the PASS theory. This is a preliminary look at these questions, and the limitations of the study must be considered before its possible implications are discussed. It is important to note that the degree to which the Dutch control group represents the characteristics of children in the Netherlands was not determined.

TABLE 2
CAS Full Scale and Subscale Means and Standard Deviations for Dutch ADHD Group and Dutch Control Group

Scale	ADHD[a]		Control[b]		Difference	*F*	*d*
	M	*SD*	*M*	*SD*			
Planning	81.8	9.3	95.6	10.5	13.9	26.699*	–1.36
Matching Numbers	6.8	1.8	10.1	2.7	3.3	24.975*	–1.32
Planned Codes	6.9	1.9	8.8	1.6	1.9	18.411*	–1.13
Planned Connections	7.6	2.0	9.0	2.0	1.4	7.175*	–0.71
Attention	87.3	10.6	102.2	11.6	14.9	24.926*	–1.32
Expressive Attention	7.9	2.8	10.3	2.2	2.4	14.834*	–1.01
Number Detection	8.4	2.5	11.0	2.4	2.6	16.036*	–1.07
Receptive Attention	7.5	2.3	9.7	2.5	2.3	12.318*	–0.93
Simultaneous	95.3	13.7	101.2	12.7	5.9	3.009	–0.46
Nonverbal Matrices	8.9	2.7	10.2	2.5	1.4	3.917	–0.52
Verbal–Spatial Relations	8.5	2.5	9.3	2.6	0.8	1.489	–0.32
Figure Memory	10.5	2.4	11.2	2.4	0.7	1.139	–0.28
Successive	93.5	14.4	103.0	13.0	9.5	7.250	–0.71
Word Series	7.9	2.5	9.6	2.3	1.8	7.980	–0.75
Sentence Repetition	10.1	3.0	11.2	2.8	1.2	2.407	–0.41
Sentence Questions	9.1	3.1	10.8	2.3	1.8	6.987	–0.69
Full Scale	85.7	12.9	100.4	11.1	14.7	23.039*	–1.26

Note. CAS = *Cognitive Assessment System* (Naglieri & Das, 1997); ADHD = attention-deficit/hyperactivity disorder.
[a]$n = 20$, [b]$n = 51$.
*Significant at $p < .003$ (Bonferroni correction).

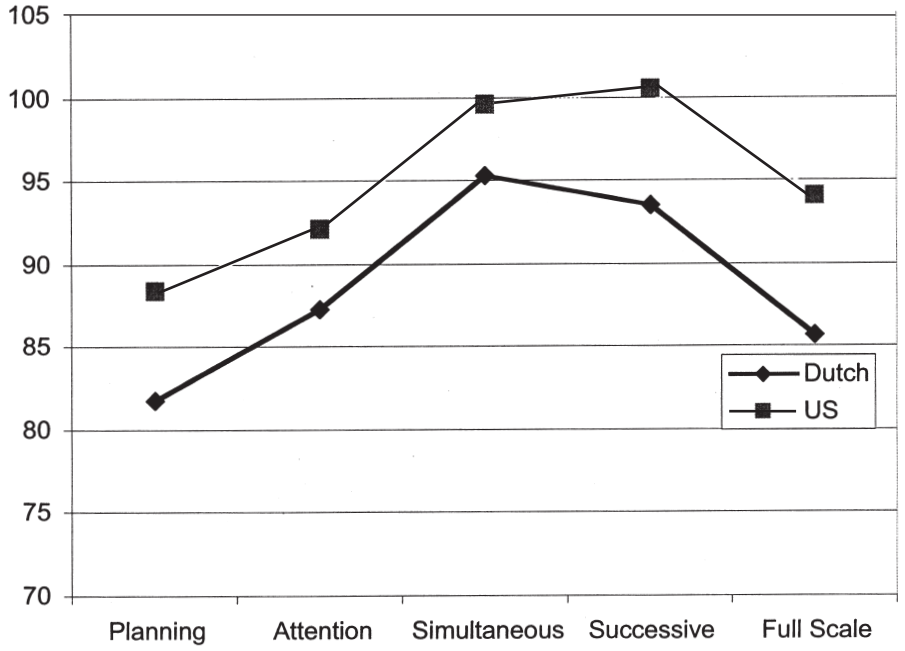

FIGURE 1. Predicted growth in oral reading fluency for at-risk and not-at-risk first grade children.

However, because the sample had been randomly selected, it can be assumed that this sample is representative of the Dutch population. Second, U.S. rather than Dutch norms were used in this study to compare the Dutch children with and without ADHD. Despite these limitations, some preliminary conclusions are offered.

The findings for the control group showed that the Dutch children scored very similar to the U.S. standardization sample on three out of four scales of the CAS and the Full Scale. The two Planned Codes and Planned Connections subtests appear most responsible for the lower overall Planning score. Researchers should examine the possible reasons why these two subtest scores were most discrepant from the U.S. normative group. For example, Dutch children may not be familiar with instructions like those used in Planned Codes: "You can do it any way you want." Further research can help determine if a revised instruction for this subtest might yield other results. More important, however, the main finding of this portion of the study was that the scores on Attention, Simultaneous, and Successive Processing scales did not differ substantially from the U.S. population. This finding warrants further corroboration given the size and characteristics of the current sample.

The second finding of this study was that the CAS scores of Dutch children with ADHD differed from those of Dutch children without ADHD. The children with ADHD showed lower scores on the CAS Planning and Attention scales. The results for Planning correspond with expectations based on previous research and are comparable with U.S. research (Das & Naglieri, 1997; Naglieri, 2003; Naglieri et al., 2003; Paolitto, 2000). The results for Attention are somewhat different from previous research in this area in that, typically, U.S. children with ADHD (combined type) have low Attention scores that are not as low as their Planning scores. This finding also merits further research, particularly regarding the characteristics of the Dutch group of children with ADHD. It is possible that there are more children with the inattentive type of ADHD in the Dutch sample than there have been in the U.S. samples of children with ADHD.

The results of the present study also suggest that the Dutch children earned scores that were similar to the U.S. population on the overall Successive Processing scale but lower scores on the Word Series subtest than the U.S. sample. However, the other two Successive Processing subtests (Sentence Repetition and Sentence Questions) were about average. This suggests that the translation and adaptation of the CAS into Dutch should be carefully examined in future research to determine if there are any subtle differences between the two versions that could make that particular subtest more difficult. Another possible reason for the lower Successive scale score may be related to the nature of the Dutch sample. Most of the children with ADHD in this study were in a school for children with special educational needs. Although the most important feature of these children was their hyperactivity and attention problems, it is possible that these children also had minor learning problems, because children with ADHD often perform below average on reading (Olson, 1996). Researchers (e.g., Naglieri & Das, 1997) have found that children with reading problems perform relatively low on measures of successive processing. The differences between the Dutch and the U.S. group could also be related to this finding, although the sample did not contain children with serious reading problems or reading disabilities. Further research is needed to examine differences and similarities of children with ADHD only or with a combination of ADHD and learning problems.

From this study, we can conclude that there is good reason to further investigate the utility of the CAS in the Netherlands. The CAS seems to provide a good way to examine different cognitive capacities and may have utility for diagnosing children. The group of children with ADHD in this study, for example, showed a specific PASS

profile corresponding with the expectations about their cognitive functioning. It may also be important to study separate profiles for other specific disorders and their possible diagnostic utility. However, more research is needed about the relation between CAS scores and disorders other than ADHD for Dutch children. Further research should also determine what added value an intelligence test like the CAS provides above more traditional tests used in the Netherlands, like the WISC-III and the *Revisie Amsterdamse Kinder Intelligentie Test* (Bleichrodt, Drenth, Zaal, & Resing, 1984).

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