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THE RELATIONSHIP BETWEEN THE COGNITIVE ASSESSMENT SYSTEM AND THE TEACHER’S REPORT FORM FOR REFERRED CHILDREN

DISSertation

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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2000

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ABSTRACT

Relationships between Planning, Attention, Simultaneous, and Successive (PASS) cognitive processes and problem behavior were examined using archival data for a sample of students referred for special education evaluations (n = 182). PASS processes were measured using the Cognitive Assessment System (CAS), and measurement of problem behaviors was obtained from Teacher Report Form (TRF) scores.

Correlational and profile analyses were conducted to test two hypotheses founded upon previous research. First, it was hypothesized that subjects with high scores on measures of externalizing behavior would have low scores on cognitive measures of Planning and/or Attention. Secondly, it was hypothesized that subjects with high scores on measures of internalizing behavior would have low scores on measures of cognitive Planning.

Support for the first hypothesis was gained from findings that subjects with high TRF Inattentive Syndrome and Externalizing Composite Scale scores also manifested cognitive processing problems, reflected in their CAS Planning and Attention scores. However, statistically significant relationships between CAS Planning or Attention and the TRF Aggressive Scale were not found.

The second hypothesis was supported by findings that subjects with high TRF Internalizing Composite scores also manifested cognitive processing problems in CAS
Planning, but Planning was not significantly associated with TRF Anxious or Social Withdrawal Syndrome Scale scores. Relationships between TRF internalizing scales and CAS Attention, Simultaneous, and Successive scales were found to be significant, though, indicating that internalizing problems are potentially associated with a wider range of cognitive processing difficulties than had previously been reported.

The TRF Unpopular and Self-Destructive Syndrome Scales, which have been described as measures of a mix of internalizing and externalizing behaviors, were also found to be significantly associated with CAS Planning and Attention. These findings offer further support for the hypothesized relationship between these cognitive processes and problem behavior.
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CHAPTER 1

INTRODUCTION

Opening Statement

The cognitive abilities of children with learning disabilities and mild developmental delays have been examined by researchers in education and psychology for decades (Baroff, 1991; Swanson, 1987). The study of cognitive ability in children with behavioral problems, however, has received much less attention (Al-Hilawani & Poteet, 1995). It is reasonable to conclude from the research that is available in these fields that cognitive processing deficits of some kind affect at least some children with problem behavior, but the association between these two areas has not been adequately explored (Daley, Nagle, & Onwuegbuzie, 1997).

This study will examine relationships between the cognitive processes of Planning, Attention, Simultaneous processing, and Successive processing (PASS) and the behavioral characteristics of children referred for special education eligibility assessment. The PASS processes will be evaluated using the Cognitive Assessment System (CAS; Naglieri & Das, 1997a). Student behavior will be assessed using the Teacher's Report Form (TRF; Achenbach, 1991). Relationships between CAS and TRF
scores will be analyzed. This first chapter presents the justification for the study, the objectives sought, a description of the questions to be investigated, procedures to be used, the limitations of the study, and definitions of key terms.

Justification

Cognition and Behavior. The definition, nature, and characteristics of problem behavior in children have been highly disputed (Center, 1993; Gaoni, Black, and Baldwin, 1998; Kauffman, 1993; Kauffman, Cullinan, & Epstein, 1987). Associations between problem behavior and many variables have been reported, including gender differences (e.g. Rutter et al., 1970), socio-economic or socio-demographic status (Brown, 1984; Frick et al., 1989; Offord, Adler, & Boyle, 1986; Sawyer et al., 1990), social competence (Dodge, 1980; Patterson, Reid, & Dishion, 1992), childhood abuse (Fontana & Moolman, 1991; Garbarino et al., 1986; Hart et al., 1989), family factors such as size and marital discord (Rae-Grant et al., 1989; Richardson et al., 1985; Rolf, 1972; Werner, 1985), biological factors (Chess & Thomas, 1987; Mednick & Hutchings, 1978), and cognitive deficits (Bortner & Birch, 1969; Robins, 1991; Rutter et al., 1970; Williams et al., 1990). A unified perspective has remained elusive, partly due to disputes over definitions of behavior problems (Center, 1993), differences in assessment practices (Clarizio & Higgins, 1989), and complexities such as co-morbidity (Rock, Fessler,
Church, 1997). The only clear consensus at this point seems to be that this is a complex issue; many variables can influence the onset, prevalence, and severity of problem behavior in children.

In the fields of education and school psychology, the relationship between cognitive ability and problem behavior has received relatively little attention (Daley, Nagle, & Onwuegbuzie, 1997). Two frequently observed trends in research involving traditional IQ tests suggest that children with severe behavioral problems manifest either general deficits in cognitive ability (Bergman & Walker, 1995; Kinnison, 1988; Mastropieri, Jenkins, & Scruggs, 1985; Schonfeld, et al., 1988; Scruggs & Mastropieri, 1986; Ysseldyke et al., 1988), or deficits in performance on verbal tasks relative to nonverbal tasks (Andrew, 1974; Lewandowski, et al.; 1977; Paget, 1982; Saccuzzo & Lewandowski, 1976). Research involving non-traditional measures of cognitive ability has shown that more precise information may be available (Moffitt & Lynam, 1994; Stephens, Clark, & Kaplan, 1990; Thurber & Hollingsworth, 1994). In a call for greater understanding of this topic, Center (1993) questioned whether all children with severe behavioral problems do exhibit cognitive deficits, and whether there are critical cognitive deficits in these children which can be identified and possibly linked to the problem behavior. Providing answers to these questions is the central issue of this study.

**PASS Theory.** Before the cognitive correlates of problem behavior in children can be adequately explored, a clear definition of cognition, and how it is to be measured, is needed (Costello, 1993). The inconclusive and often contradictory research findings in this area of study have been attributed to neglect of this necessary step (Costello, 1993;
Daley, Nagle, & Onwuegbuzie, 1997). The PASS theory of cognitive processes, which was recently operationalized in the Cognitive Assessment System (CAS; Naglieri & Das, 1997a), offers a solution for both definition and measurement of cognition, as well as a theoretical connection to problem behavior.

The beginnings of PASS theory were derived from the writings of the Soviet neuropsychologist, Alexander Luria (1966, 1973, 1980, 1982), who has been recognized as the “most frequently cited Soviet author in American, British, and Canadian psychology periodicals” (Solso & Hoffman, 1991, p. 251). Luria theorized that cognitive processes fall into three inter-related but distinct functional units, which are unique in both purpose and general locality within the brain. The first functional unit, Planning, is localized within the anterior cortex and involves executive decision making, impulse control, and organization of conscious activity. The second unit, Attention, is localized in portions of the brain stem, and is responsible for maintaining cortical arousal. The third unit encompasses both Simultaneous and Successive processes and is localized in the parietal, occipital, and temporal cortical areas. Simultaneous processing is the integration of separate stimuli into a single conceptual or perceptual whole or group. Successive processing involves the integration of stimuli into a specific serial order that forms a chain-like progression. PASS processes are not viewed as isolated constructs, but as interdependently involved in nearly all human mental activity.

PASS theory, especially planning, may be very useful for exploring the relationship between cognitive processing and behavior problems. Luria (1966, 1973,
1980) reported that individuals with damage to the frontal brain lobe tend to exhibit severe problems in regulating their behavior and emotional state. Naglieri and Das (1997b) observed that individuals with severe behavioral problems manifest difficulty with control of behavior, interpersonal problems, and impulsivity, and that these problems can be associated with poor performance on tests of planning, the cognitive process localized in the frontal cortex. These observations are far from isolated; Dubois, et al. (1995) wrote, "...it is generally agreed today that the prefrontal cortex plays a major role in higher behavioral functions such as planning, problem-solving, and conceptualization" (p. 41).

**PASS and Problem Behavior.** Several studies have explored the relationship between behavior and PASS processes, using several versions of the CAS (Das & Naglieri, 1988; Das & Naglieri, 1994; Naglieri & Das, 1997a). Hurt & Naglieri (1992) found a relationship between selective attention and adolescent delinquency. Saneda (1993) reported that children with emotional disturbance (ED) and or combined conduct/hyperactive problems scored lower than controls on various PASS processes in the Simultaneous and Successive areas. Dixon (1994) showed that Planning was a significant predictor of both teacher reported and self-reported anxiety in students. A relationship between poor Successive processing and elevated scores on teacher reports of conduct problems, depression, and autistic-like behaviors was reported by Gutwirth (1997). Daley, Nagle, & Onwuegbuzie (1997), however, reported that children with ED manifested generalized deficits on all PASS processes.
Results described by Naglieri and Das (1997b) appear more consistent with PASS theory; students with ED in this study earned average Planning scores which were significantly lower than the other three CAS PASS Scale scores. Naglieri & Das (1997b) concluded, "These findings are consistent with reports of executive functioning deficits in children with disruptive behavior disorders (Grodzinsky & Diamond, 1992; Moffitt, 1993; Moffitt & Lynam, 1994)" (p. 79). Enns (1998) reported similar findings with a sample of male adolescent delinquents, whose mean CAS Full Scale score, and mean scores on measures of Planning, Attention, and Successive processing were significantly lower than mean scores from the CAS standardization sample.

All of these studies have notable limitations. First of all, the sample size in several of these studies was small (Enns, 1998: n = 14; Naglieri & Das, 1997b: n = 17; Saneda, 1993: Conduct Disorder: n = 19, Hyperactive/Conduct Disorder: n = 12). Secondly, most studies to date have used either experimental versions of the CAS (Das & Naglieri, 1988, 1989) or the standardization version (Das & Naglieri, 1994), not the current published version (Naglieri & Das, 1997a). Third, these studies differ greatly in their approach to defining and measuring problem behavior. For example, Saneda (1993) began with three groups of 30 each using special education program placement as the defining criterion, but then ended up with vastly unequal sample sizes when teacher reported behaviors were used to refine group characteristics. Daley, et al. (1997) used a behavior rating scale to determine whether their ED sample was heterogeneous with regard to presenting problems (it was), but then still analyzed the sample as a homogeneous entity. It is reasonable to hypothesize that the heterogeneity of the sample
may have affected their results, especially if children with differences in severity and/or
type of problem behavior could be categorized by their PASS performance, as suggested
by Daley, et al. (see chapter two for more on this issue). Finally, Dixon’s (1994) sample
contained no subjects receiving special education services for ED, even though this is the
student population that is most likely to suffer from aggression or anxiety.

In spite of these limitations, the studies summarized in the previous section
illustrate some of the existing potential for expanding knowledge of the relationship
between cognitive processes and problem behavior. According to PASS theory, it is
reasonable to hypothesize that children with disruptive problem behaviors may exhibit
deficits in cognitive planning (Naglieri & Das, 1997b). The studies summarized above
also indicate there may be a connection between planning and non-disruptive problems
such as anxiety, and between problem behavior and the other PASS processes.

**Measuring Problem Behavior.** In addition to choosing a framework for cognitive
processes, investigators who examine the relationship between cognition and behavior
also need to select a framework for the description or categorization of type and intensity
of problem behavior (e.g., Center, 1993; Costello, 1993). Differentiating students simply
by special education program placement, a criteria used in many studies, has been shown
to be insufficient (e.g., Lopez, et al., 1996). Many other studies have used clinical
diagnoses to define their samples (Bergman and Walker, 1995; Bortner and Birch, 1969;
Dean, 1977; Zimet, et al., 1994), but this approach has also been criticized because of
disagreements about eligibility criteria and questions about the validity of clinical
categories (Achenbach, 1995; Robins, 1991).
Valid and reliable theoretical frameworks for describing problem behavior have been empirically derived using statistical procedures for about the last 60 years (Achenbach, 1978, 1982, 1985; Cattell, 1947; Eysenck & Eysenck, 1964; Vernon, 1964). Such studies have yielded a number of fairly specific behavior syndromes, many of which consistently fall into broad descriptive categories (Achenbach, 1991; Achenbach & Edelbrock, 1978; Cattell, 1947, 1990; Eysenck, 1947; Macfarlane, 1939).

Macfarlane (1939), for example, was among the first to document the observation that children's behaviors tend to occur in clusters. Specific behaviors associated with withdrawing from peers, introversion, or excessive reserve were observed as occurring more often in some children, while other children were observed to more frequently display behaviors such as quarrelsome-ness, mood swings, temper tantrums, and competitiveness. Macfarlane described these clusters as internalized and externalized attempts by these children to adjust to their environment.

In a similar vein, Eysenck (1990) summarized three major dimensions of empirically derived personality constructs as a continuum, with extraversion-introversion (e.g. sociable, lively, active, carefree, etc.) in the center, dysfunctional extraverted constructs on one end (aggressive, antisocial, impulsive, etc.), and dysfunctional introverted constructs on the other (anxious, depressed, moody, emotional, etc.). This structure, Eysenck asserted, has been found consistently in many factor-analytic studies of behavior (Eysenck & Eysenck, 1985). The internalizing and externalizing identifiers have often been used as descriptive terms in the assessment of behavior, although all behaviors do not clearly fit within these categories (e.g., Achenbach, 1991, 1995).
Summary. The PASS cognitive processes and statistically derived constructs of behavior can serve as a strong theoretical basis for exploring the relationship between cognitive processes and problem behavior in children. As noted above, impairment in planning is theoretically associated with the impulsive character of individuals who have disruptive (e.g. externalizing) behavior disorders (Dixon, 1994; Naglieri & Das, 1997b). Internalizing behaviors, such as anxiety, may also have a connection to planning (Dixon, 1994). The other PASS processes may have some relationship to internalizing or externalizing problem behaviors as well (Daley, et al., 1997; Enns, 1998; Gutwirth, 1997; Hurt & Naglieri, 1992; Saneda, 1993). A comparison of PASS constructs and empirically derived dimensions of problem behavior should help to answer Center’s (1993) questions of whether all students with behavior problems manifest cognitive deficits, and which (if any) critical deficits are associated with the problem.

Objectives

The purpose of this study will be to explore the relationship between the cognitive processes of Planning, Attention, Simultaneous processing and Successive processing, using CAS scores, and statistically derived categories of problem behavior using teachers’ ratings on the Teacher’s Report Form (TRF; Achenbach, 1991). Based upon previous research and an understanding of the PASS theory, two hypotheses have been formulated. First, it is hypothesized that students with high externalizing Syndrome Scale or Composite scores on the TRF will have low scores in either Planning and/or
Attention on the CAS. Second, it is hypothesized that students with high internalizing scores will have low scores in Planning. Testing of these hypotheses is the primary goal of this study.

The data for this study will be obtained from archival records of students referred for multifactored evaluation for suspected handicaps in a large Midwestern urban school district. All students will have been administered both the CAS and TRF as part of their multifactored evaluation. A minimum sample size of 150 students will be sought. Descriptive data, including academic achievement test scores, age, gender, race, program of referral, and placement, will also be collected and analyzed.

CAS and TRF scores will first be examined for correlational relationships. Research question one, listed in the following section, addresses this analysis. Next, cut scores will be applied to the TRF Syndrome and Composite Scales to divide the sample into low and high problem behavior groups. CAS PASS Scale profiles will be examined for differences across these low and high groups. Three cutscores will be used to examine whether the PASS Scale profiles show consistent changes as TRF Scale scores rise. Research questions two through nine address these analyses.

Thirdly, TRF Syndrome Scale score profiles of students with significant cognitive weaknesses (CW) on the CAS will be examined for significant differences. Cognitive weaknesses will be identified using a procedure outlined by Naglieri (1999b). This procedure is explained fully in the definitions section of this chapter. TRF profiles for subjects with a CW in Planning, Attention, Simultaneous, Successive, or No CW will be analyzed. Research questions ten through fourteen address these analyses.
Research Questions

1. What are the correlational relationships between CAS PASS Scale, TRF Syndrome Scale, and TRF Composite scores?

2. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Anxious Syndrome Scale scores than for students with high TRF Anxious scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

3. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Social Withdrawal Syndrome Scale scores than for students with high TRF Social Withdrawal scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?
4. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Unpopular Syndrome Scale scores than for students with high TRF Unpopular scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

5. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Self-Destructive Syndrome Scale scores than for students with high TRF Self-Destructive scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

6. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Inattentive Syndrome Scale scores than for students with high TRF Inattentive scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?
7. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Aggressive Syndrome Scale scores than for students with high TRF Aggressive scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

8. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Internalizing Composite scores than for students with high TRF Internalizing scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

9. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Externalizing Composite scores than for students with high TRF Externalizing scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?
10. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Planning on the CAS?

11. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Attention on the CAS?

12. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Simultaneous on the CAS?

13. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Successive on the CAS?

14. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with no significant cognitive weaknesses on the CAS?

Limitations of the Study

The sample of students to be included in this study will be a sample of convenience; no random sampling of individuals with the required characteristics will be done since the data to be gathered are archival. All individual subjects in the sample will have been referred for psycho-educational evaluation for suspected handicapping conditions. Non-referred individuals with the required data are not included.
Subjects were evaluated in non-clinical conditions. The CAS was administered and scored by certified, licensed, or intern school psychologists, usually in a regular public school environment during regular school hours. Testing room conditions, time of day, noise levels, and other such variables were not controlled. The TRF was completed by teachers, principals, or other school staff who presumably were familiar with the student. Scoring of TRF protocols was usually completed by secretarial staff using a computer scoring program. Due to the program requirement that data be entered twice, the likelihood of clerical errors in scoring is greatly reduced.

The CAS can be administered as either an eight subtest Basic Battery or a twelve subtest Standard Battery. Since not all subjects within the sample were administered the Standard Battery, all CAS protocols will be scored using Basic Battery criteria. This may result in a slight decrease in reliability (see Table 4.1 in Naglieri & Das, 1997b).

The 1991 profile of the TRF (Achenbach, 1991) was used with the subjects in this study, but pre-1991 scoring procedures were employed. This practice is permissible according to the TRF author (Achenbach, 1991), but, since pre-1991 TRF Syndrome Scales are not consistent across age and gender, only Syndrome Scales for which there is data on all subjects will be used in this study. These Syndrome Scales are named Anxious, Social Withdrawal, Unpopular, Self-Destructive, Inattentive, and Aggressive. The TRF Internalizing and Externalizing Composite Scales will also be examined in this study.

TRF Syndrome Scale and Composite results are reported as T scores. Normally, T scores have a mean of 50 and a standard deviation of 10. However, pre-1991 TRF
Syndrome Scales have a minimum possible T score of 55, and raw scores are not distributed evenly. This may result in a positively skewed distribution on some Syndrome Scales which could affect analysis results. Corrections or adaptations for restriction in range, unequal variance, or uneven score intervals will be done where warranted.

Definition of Terms

**Problem Behavior.** The terms “behavior problem” and “problem behavior” are used in this document as a general referent to both externalizing and internalizing problems. It is intended to include problems commonly perceived as emotional, such as anxiety or social withdrawal. Because the assessment of these problems in this study will be derived from teacher’s reports of behavior, it is more appropriate to use the term “behavior problem” than “emotional problem” or “behavioral/emotional problem.” Similar terms used throughout this document, such as “emotionally disturbed,” “brain damaged,” or “serious emotional disturbance” relate to the terms used in the particular research under discussion at that point.

**Cognitive Weakness.** A subject will be determined to have a specific CAS cognitive weakness if one PASS Scale score both differs significantly from the mean of all PASS scale scores for that subject, and is also below a pre-selected cutoff (a standard score cutoff of 85 will be used in this study). Statistically significant differences between
mean and individual PASS Scale scores will be determined using values from Table D.3 in the CAS Administration and Scoring Manual (Naglieri & Das 1997a, p. 198).

Profile Analysis. This term refers to a statistical analysis procedure used to determine whether two or more groups of subjects perform differently on a battery of tests. In this study, profiles which will be analyzed include the PASS Scale of the CAS, and the TRF Syndrome Scales. Procedures and requirements for profile analysis are fully explained in chapter four.
CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter summarizes educational and psychological research studies of cognitive ability and problem behavior in children. Studies relating to the development of the PASS theory and of empirically based assessment of behavior will also be summarized. The assessment instruments used in this study will also be briefly described.

Studies of Cognition and Problem Behavior

IQ and Behavior. Seminal studies of intelligence in children with problem behavior have typically involved the use of traditional IQ tests. Many of these studies have yielded support for one of two trends: those which show general cognitive deficits in children with problem behavior as compared to the norm (e.g. Bowman, 1959; Lyons & Powers, 1963; Rutter, Tizard, & Whitmore, 1970) and those which distinguish patterns of relative cognitive strengths and weaknesses (e.g. Blank, 1958; Camp, 1966; Prentice & Kelly, 1963; Wechsler, 1944). For example, Rutter, Tizard, & Whitmore (1970) reported
that children identified as neurotic, antisocial, or both earned significantly lower mean IQ scores than controls on a short form of the Wechsler Intelligence Scale for Children (WISC; Wechsler, 1949). Wechsler (1944) found evidence of this general deficit hypothesis, but he also reported that children with problem behavior typically earn higher Performance IQ than Verbal IQ scores on the WISC.

Bortner and Birch (1969) criticized earlier studies because of their lack of sufficient detailed information about the intellectual characteristics of children with problem behavior. They suggested that such information could serve as a basis for individualizing instructional practices for these children. WISC subtest scores of emotionally disturbed (those with psychiatric diagnoses, $n = 131$) and brain damaged (those with neurological diagnoses, $n = 116$) children were analyzed for significant patterns. While the mean WISC Full Scale IQ score for the emotionally disturbed sample (mean = 88.101) was higher than the mean of the brain damaged group (mean = 76.98), both groups consistently exhibited mean scores on four WISC subtests (Comprehension, Arithmetic, Digit Span and Coding) that were lower than the other subtest scores. Bortner and Birch claimed that the last three of these subtests "... are frequently interpreted as clinical indicators of attentional and concentration abilities" (p. 362), and concluded that children with emotional disturbance or brain damage manifest disabilities in attention and concentration. Evidence of a consistent directional Performance and Verbal IQ difference was not found.

Subtest analysis became a frequently used method of study in the decades following Bortner and Birch (1969). By the late 1970's, many WISC subtest patterns had
been hypothesized as potentially useful for differentiating children with behavioral problems from those without (e.g. Saccuzzo & Lewandowski, 1976; Wechsler & Jaros, 1965). Dean (1977) analyzed fourteen such patterns using the revised WISC (WISC-R; Wechsler, 1974) for a sample of adolescent males with conduct disorders (n = 41). This sample manifested depressed WISC-R Verbal IQ scores relative to Performance IQ scores, supporting Wechsler's (1944) report, but Dean concluded that impairments in subtest scores “... do not tend to promote differential diagnosis” (p. 489). Dean also suggested that part of the reason studies yield differing results is that childhood disorders (such as conduct disorder) have imprecise definitions.

The Performance-Verbal (PIQ>VIQ) discrepancy hypothesis was reported in a number of studies (Andrew, 1974; Lewandowski, et al.; 1977; Paget, 1982; Saccuzzo & Lewandowski, 1976), despite the evidence that such discrepancies were common in the WISC-R standardization sample (Kaufman, 1976). Clarizio and Veres (1983) tested the PIQ>VIQ discrepancy hypothesis and another popular WISC-R diagnostic pattern (high Similarities, low Information) in 64 emotionally impaired students and 290 controls (evaluated but not placed in any special education program). Neither pattern yielded useful information for diagnosing emotional impairment. Clarizio and Veres concluded, “... the use of these data [e.g., WISC-R scores] for differential diagnosis is ... not much better than a random process. ... there is no credible support for this practice” (1983, p. 414).

The PIQ>VIQ discrepancy hypothesis, however, has not been laid to rest. For example, Wong & Cornell (1999), using the third edition of the WISC (WISC-III;
Wechsler, 1991), found a relationship between PIQ>VIQ discrepancies and both delinquency and social problem solving in a sample of adolescent male delinquents (n = 95). Caspi and Moffitt (1995) have suggested the PIQ>VIQ discrepancy is evidence that delinquent children may have specific deficits in language use. However, portraying the WISC Verbal Scale as a measure of language is a disputable practice (e.g. Enns, 1998; Hurt & Naglieri, 1992).

The hypothesis that children with problem behavior manifest general deficits in cognitive ability is less disputed; general deficits have been reported in studies using the WISC-R (e.g. Bergman & Walker, 1995; Kauffman, Cullinan, & Epstein, 1987; Kinnison, 1988; Paget, 1982; Schonfeld, et al., 1988; Ysseldyke et al., 1988) and the WISC-III (e.g. Teeter & Smith, 1993). Mastropieri, Jenkins, and Scruggs (1985) concluded that general cognitive and academic achievement deficits are the most consistent findings across studies of the intellectual characteristics of children with problem behavior or emotional disturbance.

Not all studies using the WISC instruments, however, support the general deficit hypothesis. Hodges and Plow (1990) reported mean WISC-R IQ scores in the average range for a sample of children (n = 76) receiving inpatient treatment in a psychiatric facility. Zimet, et al. (1994) also reported average range WISC-R Full Scale IQ scores (mean = 96.4) for their sample of psychiatrically disordered children (n = 120). Only 16 percent of this sample had “clinically rare” (i.e. 19 points or more) PIQ>VIQ discrepancies; but five percent had significant VIQ>PIQ discrepancies. Zimet, et al. (1994) attributed the diverse findings in studies of this type to methodological and
sampling differences, but concluded that “… WISC-R scores do not provide a reliable tool in discriminating among emotional disorders in school-age children” (p. 136).

**Beyond IQ: Related Findings.** Measures other than traditional IQ tests have been used to explore the relationship between cognitive ability and problem behavior in children. For example, Curley and Pabis (1978) administered tasks associated with the Piagetian concepts of class inclusion, class exclusion, and complement of set to samples of normal and emotionally disturbed individuals (ages 6 – 22 years). The performance of the emotionally disturbed sample (n = 120) on these tasks was reported as deficient compared to normals (n = 120).

Lutkemeier and Wade (1984) administered Raven’s Standard Progressive Matrices (Raven, 1938) and measures of reaction time to samples of emotionally handicapped (n = 108), regular education (n = 64), and gifted students (n = 76). These measures were viewed as being less susceptible than traditional IQ tests to extraneous factors, such as cultural or socio-economic differences. Results, though, were somewhat consistent with the general deficit hypothesis: Matrices scores were significantly lower for the emotionally handicapped group and reaction times were generally slower. Lutkemeier and Wade concluded that, although the findings suggest that intelligence has some bearing on the diagnosis of emotional handicap, “… there is no compelling reason to assume that intellectual ability plays an important etiological role” (p. 9).

**Theory-Based Assessment.** By the early 1980’s, cognitive assessment instruments with a more theoretical foundation than their predecessors had come into common use (Kaufman, 2000). One such instrument was the Kaufman Assessment Battery for
Children (K-ABC; Kaufman & Kaufman, 1983). The K-ABC was based on a blend of theories, including psycho-biological cerebral specialization, neuropsychology, and a factor-derived model of cognitive ability (Kaufman, 2000). A few studies of children with problem behavior were conducted using the K-ABC. Freeman, et al. (1985) analyzed K-ABC and WISC-R scores for a sample of high functioning autistic children (n = 21). WISC-R Verbal IQs were significantly lower than K-ABC Sequential scores, but not significantly different from Simultaneous Scale scores. A portion of the sample (n = 5) earned significantly higher K-ABC Sequential than Simultaneous Scale scores, contrary to predictions that the opposite would be true (e.g. Tanguay, 1984).

Pommer (1986) compared K-ABC and WISC-R results for a sample of seriously emotionally disturbed children (n = 56). K-ABC and WISC-R scale and composite scores for this sample were significantly below the mean for the normal population (K-ABC Mental Processing Composite mean: 83.23; WISC-R Full Scale mean: 73.75). The mean K-ABC Simultaneous score was also lower than the mean Sequential score for this sample. Comparisons between K-ABC and WISC-R scales yielded stronger relationships between the K-ABC Simultaneous Scale and WISC-R scales than between Sequential and WISC-R. Pommer (1986) suggested that these results indicate that the K-ABC and WISC-R both measure intelligence as a global construct, but that each also measures some unique aspects of intelligence.

Neuropsychological Contributions. There have been a number of studies of children with problem behavior using neuropsychological assessment instruments. For example, Stephens, Clark, & Kaplan (1990) administered either the Luria-Nebraska
Neuropsychological Battery: Form I (LNNB; Golden, Purisch, & Hammeke, 1985) or Luria-Nebraska Neuropsychological Battery: Children’s Revision (LNNB-C; Golden, 1987) to a sample of 65 children with emotional disturbance. All subjects had previously been given the WISC-R, which yielded mean IQ scores of 84.3 for the LNNB group and 87.8 for the LNNB-C group. Luria-Nebraska results were compared to the tests’ standardization samples. Ten of the fourteen LNNB summary scale scores differed significantly from the norm (p < .01); three were higher (Motor Functions, Left Sensorimotor, Right Sensorimotor) and seven were lower (Rhythm, Visual Functions, Writing, Reading, Arithmetic, Memory, and Intellectual Processes). All but two (Motor Functions and Rhythm) of the LNNB-C mean scores were significantly lower for the emotionally disturbed group. In general, Stephens, Clark, and Kaplan reported that the subjects manifested greater difficulty on complex cognitive tasks, and less difficulty on simpler sensory-motor and perceptual tasks, and suggested that these variations may have arisen from interference with attention or concentration caused by the emotional disturbance of the subjects.

Thurber and Hollingsworth (1994) administered the LNNB Form II to 45 adolescent psychiatric hospital patients. Parents of the subjects also completed the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983). The Mean LLNB Summary Scale score was cited as evidence of significant general cerebral dysfunction (approximately one standard deviation above the normative mean), and a strong correlation (0.53, p > 01) between neuropsychological dysfunction on the LLNB and
hyperactive symptomatology on the CBCL was found. LLNB subscale scores for this sample were not reported by Thurber and Hollingsworth, but they suggested that diffuse neuropsychological impairment may underlie symptoms of hyperactivity.

Matson and Fischer (1991) tested the theoretical relationship between externalizing and internalizing behaviors, brain frontal lobe functions, and IQ. Samples (n = 12) of high Internalizing and Externalizing students were obtained using TRF (Achenbach & Edelbrock, 1986) ratings of students in classes for emotional disability. A control sample (n = 12) was drawn from the regular education student population. The three samples were matched on WISC-R Full Scale IQ, age, and socioeconomic status. All subjects were given the Wisconsin Card Sorting Test (WCST; Chelune & Baer, 1986), an instrument designed to assess frontal lobe functions including concept formation (Categories Achieved), suppression of ongoing activity (Perseverative Errors), and reactivity to extraneous stimuli (Failures to Maintain Set). Significant (p < .01) between groups effects were found for WCST Perseverative Errors and the third factor of the WISC-R, commonly called the Freedom From Distractability factor. Externalizers exhibited significantly more WCST Perseverative Errors and had lower scores on WCST Categories Achieved than either Internalizers or controls. Matson and Fischer (1991) suggested that “... Externalizers process information differently than do both Internalizers and normal controls” which “... cannot be explained by SES, age, or FSIQ” (p. 148).

Moffitt and Lynam (1994) examined studies of neuropsychological performance in children with problem behavior and found that, “... across studies, antisocial
youngersters were impaired in two specific mental domains: language-based verbal skills and ‘executive’ or self-control functions” (p. 236). Executive functions include sustaining attention, formulating goals and plans, initiating purposeful behavior, and self-monitoring the effectiveness of that behavior. Moffitt and Lynam noted that Luria (1961; Luria & Hornskaya, 1964) identified language as essential to the development of self-control, which suggests that these two identified areas of deficit may be related.

A recent, longitudinal study added support to Moffitt and Lynam’s (1994) findings. Nigg, et al. (1999) examined neuropsychological and cognitive variables in relationship to onset of problem behavior in young children. They administered measures of IQ, reading skill, verbal fluency, mental inhibitory control, and visual spatial ability to a sample of 235 regular education elementary children over a period of two years. No significant effects for IQ (estimated from two WISC-R subtests), reading skill, or visual spatial ability were found, but regression analyses yielded significant effects for measures of inhibitory control (trail making and color word interference tasks) and verbal fluency on outcome measures of behavior problems (teacher completed measures, including the TRF). Effects were described as “small to moderate”, and Nigg, et al. concluded, “As expected, measures of inhibitory control best predicted later adjustment; verbal fluency also contributed” (p. 59).

Summary. The literature reviewed thus far shows that the use of traditional IQ measures has dominated research into the relationship between cognitive ability and problem behavior in children. Support for two major hypotheses has been found in many of these studies: children with problem behavior tend to manifest general deficits in
cognitive functioning (as measured by traditional intelligence tests), and such children often earn lower Verbal IQ than Performance IQ scores on Wechsler IQ tests (the predominant instruments used). The literature has also shown, however, that more explicit information can be obtained from tests which measure theoretically-based, specific cognitive processes. Such studies have shown that children with problem behavior may have greater difficulty than normal children when completing complex cognitive tasks, particularly tasks requiring formulation, application, and monitoring of problem solving strategies.

PASS Theory


Luria's Contributions. Through careful observation and assessment of individuals with head injuries, Luria (1966, 1973, 1980) observed that behavioral or mental disturbances arising in association with localized lesions in the brain, such as those caused by gunshot wounds, could be divided into two categories: those capable of regeneration and those which are not (Luria, 1966). Lesions leading to disturbances of
function which could not be regenerated, such as sight or hearing, were indicative of localization of that specific function to a particular area in the brain. Complex forms of behavior which can in some measure or form be regenerated, however, could not be firmly associated with any particular group of nerve cells in the cortex.

Certain general forms of cognitive processing, however, did appear to Luria to be more heavily affected by lesions in particular areas of the brain. Luria described two basic forms of what he calls synthetic activity in the cortex as follows:

The first of these forms is the integration of the individual stimuli arriving in the brain into simultaneous, and primarily spatial, groups, and the second is the integration of individual stimuli arriving consecutively in the brain into temporally organized, successive series. We shall refer conventionally to these as simultaneous and successive syntheses... These terms are not sufficiently accurate. In fact in the first case is meant the synthesis of successive (arriving one after the other) elements into simultaneous spatial schemes, and in the second - the synthesis of separate elements into successive series. We shall continue to use this terminology in the future, bearing in mind that it is conventional (Luria, 1966, p. 74).

Luria (1966 explored these processes further using tests which he devised and administered to his patients with head trauma. He found that simultaneous processes appear particularly disturbed by lesions to the occipito-parietal region of the cortex, while successive processes appear more disturbed by lesions to the fronto-temporal region. He theorized that simultaneous synthesis is genetically associated with systems responsible for spatial orientation of the body, while successive synthesis is primarily associated with the motor and acoustic systems.
An association between the frontal regions of the cortex and the organization of mental activity and regulation of complex forms of behavior was also observed by Luria (1966, 1973, 1980). He noted, that, while injuries to the frontal regions did not tend to cause the visual, hearing, simultaneous synthesis, or logico-grammatical disturbances associated with trauma to other areas, frontal injuries did tend to result in an impairment of ability to organize simple motor activity, inability to inhibit interfering behaviors, or even impaired ability to stop a chosen behavior once it has begun (Luria, 1966, Luria & Tsvetkova, 1990). Physiological studies revealed the tremendous number and complexity of neural connections between the frontal cortex and other regions of the brain (Luria, 1973). Luria wrote, “These connections ... are in a particularly favorable position for both the reception and synthesis of ... afferent impulses arriving from all parts of the brain and for the organization of efferent impulses” (1973, p. 84, 86).

Another distinct relationship between the frontal lobes, portions of the brain stem, and sections of the limbic system was also noted by Luria. This relationship appeared to primarily affect the regulation of what Luria calls cortical tone or arousal. Injury to the areas associated with this system tended to result in inattention to essential elements of information when problem-solving, impulsive answers to questions, and omitting steps in the development of plans for activities or problem solving. Luria wrote, “... maintenance of the optimal level of cortical tone is essential for the organized course of mental activity” (1973, p. 45).

In his 1973 book, The Working Brain, Luria organized his findings and associated research into a theory of cognitive processes involving three functional units
working together, all of which are necessary for the successful completion of all types of mental work. These three functional units consist of (1) the maintenance of cortical arousal, (2) the reception, processing, and retention of information via simultaneous and successive syntheses, and (3) the planning, implementation, and evaluation of complex behaviors. The theory, in its present form, is designated PASS, which stands for Planning (Luria's third functional unit), Attention (the first functional unit), and Simultaneous and Successive processing (the second functional unit) (Naglieri & Das, 1988; Naglieri, 1989).

PASS Studies. Luria (1973) cited the contributions of many other researchers as providing the foundation for his cohesive view of the three functional units which form the basis for the PASS theory (see Naglieri & Das, 1997c for a summary). A summary of studies specifically related to PASS will be reviewed in this section.

Beginning with the premise that Luria’s conceptual model accurately represents the vital cognitive processes which underlie human reasoning, Das, Kirby and Jarman (1975) proposed that these processes should be evident in existing cognitive assessment instruments. They performed principal component factor analyses on sets of test scores from seven popular assessment measures which had been administered to 60 retarded and 60 non-retarded children. When only eigenvalues greater than one were used, a two factor structure appeared. The authors concluded,
How can one describe the factors meaningfully? Factors 1 and 2 appear to correspond to the usual division of abilities into reasoning and memory. ...But this interpretation seems to be inadequate when we consider the disparate loadings for the non-retarded and retarded children on some of the tests. ...If one wishes to retain the memory-reasoning interpretation, one could say that the retarded subjects used reasoning to reproduce the designs, whereas the nonretarded subjects used memory. In visual short-term memory, on the other hand, the nonretarded subjects seem to be using reasoning predominantly, but the retarded subjects use both. ...A more appropriate label for the two factors seems to be simultaneous and successive integration (Das, Kirby, & Jarman, 1975, p. 92).

In this and other early research, tasks which were developed to measure simultaneous processing included tests such as progressive matrices, memory for designs, and copying figures. Such tasks were perceived as primarily requiring the integration of information into meaningful groups or sets for successful completion of the task. Tasks intended to measure successive processing included tests such as digit span forward, sound blending, serial recall, and sentence repetition, which were viewed as requiring the integration of information in specific serial, inter-related order. Das and colleagues (1975) showed evidence of how tasks which appear to be very similar (e.g. memory tasks) can actually be quite different from a cognitive processing perspective.

In summarizing the research on simultaneous and successive processes, Das, et al. (1979) concluded that these processes are useful as a partial basis for an information processing model of intelligence, and that Luria’s three functional units could serve effectively as a conceptual foundation for this model. They also noted the need for further development of measures of planning and attention.
Ashman and Das (1980) and Das (1980) demonstrated that a planning factor could be differentiated from simultaneous and successive factors. In Ashman and Das (1980), 104 eight grade students were administered tasks theoretically associated with planning (Visual Search, Trail Making, Verbal Fluency, Planned Composition), along with measures of simultaneous and successive processes. Principal components analysis identified a planning factor orthogonal to the simultaneous and successive factors, although not all tasks yielded significant loadings on only one factor.

Naglieri and Das (1988) adapted or devised a set of nine experimental tasks to measure planning (Trails, Visual Search, Matching Numbers), simultaneous (Figure Recognition, Tokens, Matrices), and successive processing (Word Recall, Successive Ordering, Hand Movements). These tasks were administered to a sample of 434 students in three grades (second, sixth, and tenth). A three factor structure, each with eigenvalues greater than one, emerged both by grade and total sample. The fact that some tasks loaded on different factors depending on grade was viewed by the authors as evidence that the processing requirements for the tasks vary by age. For example, a task which is relatively simple for an older child may require primarily simultaneous processing; for a younger child, the same task may be more difficult and thus invoke the need for planning. Individual differences, Kirby and Das (1990) have explained, are due to those aspects of a task which are most difficult.

With a three factor model fairly well established, Naglieri, Prewitt, and Bardos (1989) sought to identify arousal or attention as a distinct process. Selective attention tasks, derived from the work of Posner and Boies (1971) and Stroop (1935), were added
to planning, simultaneous, and successive measures. 112 fourth and fifth grade students were administered the tests, and the results were subjected to a principal components analysis. A four factor model was selected as the best description of the data, accounting for (respectively) 34 percent, 14 percent, 13 percent, and 10 percent of the variance. A fifth factor with an eigenvalue of .71 accounted for another seven percent of the variance. Naglieri, Prewitt, and Bardos concluded, “The results illustrate the robust nature of the first three factors of Planning, Successive, and Simultaneous and the feasibility of measuring an Attention factor” (1989, p. 357).

Support for PASS theory is robust: Naglieri and Das (1997c) wrote, “The development and refinement of experimental tests to measure the various PASS processes and to evaluate their practical utility and validity is provided in more than 100 published papers and several books” (p. 138). Many of these studies have shown a relationship to PASS processes and aspects of learning such as written composition (Ashman & Das, 1980, Das & Heemsbergen, 1983), reading comprehension (Das & Cummins, 1982; Kirby, 1982; Kirby & Robinson, 1987; Leong, 1984; Leong, Cheng, & Das, 1985; Stutzman, 1986), reading decoding (Cummins & Das, 1980; Das & Cummins, 1979, 1982; Das, Leong, & Williams, 1978; Kirby, Booth, & Das, 1996), and mathematics (Garofalo, 1986; Naglieri & Das, 1987).

Development of the Cognitive Assessment System (CAS). Refinement of tasks used in PASS studies led to the development of a complete assessment battery, the Cognitive Assessment System (CAS), which appeared in several experimental versions (Das & Naglieri, 1988, 1989). These instruments consisted of PASS tasks which were to
be administered in a specific order and with standard directions. Naglieri and Das (1997b) described the ongoing development and refinement of CAS tasks:

Development of each CAS subtest followed a sequence of item generation, examination, revision, and reexamination until the instructions, items, and other dimensions were refined. Each subtest was evaluated through a series of pilot tests, research studies, a national tryout, and the national standardization. Through this process, subtests were identified that predominantly involved a particular process for task completion (p. 14).

The CAS Standardization Edition (Das & Naglieri, 1994) included 14 subtests, four in each PASS area. It was administered to a total of 3072 children, age 5 through 17 years, in 68 sites across the United States (Naglieri & Das, 1997b). The normative sample was derived from test results for 2200 of these children, and the other 872 participated in studies of reliability and validity (test characteristics are summarized in greater detail in chapter three).

The current standardized version of the CAS (Naglieri & Das, 1997a) includes twelve subtests which can be administered in total or as an eight subtest Basic Battery. The test yields PASS Scale and Full Scale standard scores, and subtest scaled scores. Uses and applications of the CAS proposed by the authors include predicting academic achievement and evaluation of individuals with a variety of disabling or handicapping conditions, such as attention-deficit/hyperactivity disorders, learning disabilities, mental retardation, traumatic brain injury, serious emotional disturbance, giftedness, and
planning problems (Naglieri & Das, 1997b). Several studies offering empirical support for these claims are summarized by Naglieri and Das (1997b) and by Naglieri (1999a).

**CAS Studies of Cognition and Behavior.** Studies of PASS processes in children with problem behavior using the several versions of the CAS are briefly mentioned in chapter one. These studies are summarized in greater detail in this section.

Hurt & Naglieri (1992) studied samples of 30 delinquent and nondelinquent adolescents who were administered an experimental version of the CAS (Das & Naglieri, 1988). A significant difference between samples was found for selective attention, which was considered by Hurt and Naglieri to be consistent with research on the impulsive nature of juvenile delinquents (e.g. Curtiss, Feczko, & Marohn, 1979; Ostrov, Marohn, & Rosenwein, 1972).

Saneda (1993) investigated the cognitive processing and planning differences among three groups of male children (severe conduct problems, combined conduct/hyperactive problems, and nonclinical control). The CAS experimental version (Das & Naglieri, 1989) and an experimental questionnaire were used to evaluate planning and other cognitive processes. Groups were differentiated using the Conner's Teacher Rating Scale (Goyette, Conners, & Ulrich, 1978). Significant group differences between clinical and nonclinical groups were found, as were significant age effects. No significant differences between clinical groups were found. Univariate test results showed significant group effects for subtests within the CAS Planning (Planned Connections), Simultaneous (Figure Memory and Simultaneous Verbal), and Successive (Word Series and Sentence Repetition) domains. In all cases except one (Planned
Connections) the nonclinical group scored significantly higher than the clinical groups. However, the clinical groups' sample sizes in this study were very small (Conduct Disorder n =19; Hyperactive/ Conduct Disorder n = 12).

Dixon (1994) also used an experimental version of the CAS (Das & Naglieri, 1989) to examine the relationship between cognitive processes, anxiety and aggression. One hundred fifth grade students were administered the CAS and the State-Trait Anxiety Inventory for Children (Spielberger, et al., 1973). Classroom teachers completed the Behavior Assessment System for Children-Teacher Rating Scales (Reynolds & Kamphaus, 1992). Dixon found that Planning was a significant predictor of teacher-reported anxiety as well as a significant predictor of self-reported state anxiety. Planning was also the best predictor of teacher reported behavioral symptoms.

Daley, Nagle, and Onwuegbuzie (1997) administered the standardization edition of the CAS (Das & Naglieri, 1994) to samples of 40 children with emotional disturbance (ED) and 40 normal controls matched on age, race, and gender. Significantly lower mean scores were earned by the ED sample on all four PASS Scale areas and across 12 of the 14 subtests administered. Although 25 percent of the ED subjects had PASS Scale scores which were more consistent with the control sample, the overall results were viewed by the authors as supportive of the general cognitive deficit hypothesis summarized in the first section of this chapter.

Trends in the data led Daley, et al. (1997 to identify two clusters of subjects in the ED sample. In cluster one, the mean CAS Planning score was greater than the mean Simultaneous, which was greater than Successive, which was greater than Attention. The
pattern in cluster two was Planning > Attention > Simultaneous > Successive. The authors suggested that these trends may be evidence of subgroups within the ED population which can be distinguished using CAS score profiles. To test this, mean cluster scores were compared to behavior ratings from the Devereux Behavior Rating Scale - School Form (DSF; Naglieri, LeBuffe, & Pfeiffer, 1993), obtained as part of the study. The data showed a consistent trend in the direction of the differences between the clusters and effect sizes on three of the DSF scales (Interpersonal Problems, Inappropriate Behavior/Feelings, Depression). Daley, et al. (1997) suggested that cluster two may represent a more seriously disturbed group than cluster one.

Gutwirth (1997) examined the cognitive profiles of 60 students classified as either SLD, ED, or normal using the standardization version of the CAS, the Devereux Scales of Mental Disorders (DSMD; Naglieri, LeBuffe, & Pfeiffer, 1994), and the WISC-III. Using factor analytic techniques with the WISC-III and CAS results, Gutwirth obtained four cognitive processing factors. These were labeled Successive, Simultaneous/ Spatial, Verbal, and Planning. Subsequent cluster analysis revealed subgroups within the sample, which Gutwirth categorized as High Functioning, Conduct Disorder, Low Functioning, Conceptual/Spatial Disability, and Pure Nonverbal LD. Statistically significant findings included poor successive processing combined with elevated scores on the Conduct, Depression, and Autism scales of the DSMD in the Low Functioning subgroup, and significantly high performance on simultaneous tasks in the High Functioning group.

Naglieri and Das (1997b) examined CAS scores for 17 students who had previously been identified as emotionally disturbed (ED). The mean CAS Planning score
for this sample was lower than the other three PASS Scale scores. Naglieri & Das (1997b) reported that Planning deficits are consistent with reports of executive functioning deficits in children with disruptive behavior disorders.

Enns (1998) evaluated 14 male adolescent psychiatric patients identified as delinquent offenders using the CAS, and then compared their scores to standardization data. Significant differences (p < .05) were reported for CAS Full Scale, Planning Scale, and Attention Scale scores, which were lower than standardization sample means. Significant mean differences were also reported for two Planning Scale subtests (Matching Numbers, Planned Codes), one Simultaneous subtest (Verbal-Spatial Relations), one Attention subtest (Receptive Attention), and two Successive subtests (Word Series, Sentence Questions). Enns (1998) concluded that these results are consistent with PASS and neuropsychological theory; subjects manifested deficits in executive functions (CAS Planning), attention, and verbal functions (CAS Word Series, Sentence Questions, Verbal-Spatial Relations).

Summary. Some studies using different versions of the CAS are supportive of PASS theory in that Planning scores may be lower for children with various types of problem behavior. A relationship between externalizing behavior problems and low CAS Planning has been reported. One study has also shown a relationship between low Planning and internalizing problems. Other studies have shown that Attention and Successive processing, and possibly some aspects of Simultaneous processing, may also be related to problem behavior. Differences in research design, intent, and instrumentation render generalizations difficult.
Defining and Measuring Problem Behavior

Clinical or Medical Diagnoses. The studies reviewed thus far in this chapter have very different methodologies for the selection and evaluation of subjects with problem behavior. For example, some studies have included sets of diagnostic criteria to define samples. Bortner and Birch (1969) used the terms emotionally disturbed and brain damaged to distinguish subjects, and explicitly stated criteria for group selection in their study. One of the most distinguishable differences in criteria was that brain damaged children were required to show definite evidence of organic pathology (medical criteria), while emotionally disturbed children were not. Conversely, emotionally disturbed students were required to manifest behavior problems (disruptive, withdrawn, classroom management problems) while the brain damaged group were not. Few studies reviewed explicitly stated criteria in this manner.

The subjects in Dean (1977) were identified as “… referred for psychological evaluation as a result of conduct disorders: aggressiveness, temper tantrums, anxiety states, truancy, etc.” (p. 486-487). Specific behavioral criteria for selection are referenced. Criteria from the DSM-III-R (American Psychiatric Association, 1987) were used to assign a psychiatric diagnosis in Zimet, et al. (1994), while the subjects in Bergman and Walker (1995) were identified as “… children at risk for maladjustment” (p. 267) with parental psychiatric status serving as a distinguishing criterion.

This method of sample identification is problematic: Robins (1991) has suggested that differences over time or by geographical location can change the clinical or medical
definition of a disorder. Achenbach (1995) has criticized this method also, writing, “Discussions of child psychopathology are replete with terms that are used as if their meaning were self-evident” (p. 64), also noting that the criteria for childhood disorders in the DSM were not derived from data on actual samples of children.

**Special Education Program Placement.** Many studies have used special education program placement to define samples (Clarizio & Veres, 1983; Daley, et al., 1997; Gutwirth, 1997; Kauffman, Cullinan, & Epstein, 1987; Kinnison, 1988; Lutkemeier & Wade, 1984; Scruggs & Mastropieri, 1986; Ysseldyke, et al., 1988). But problems with this type of sample selection have also arisen: differences in legal definitions (as well as their broad and sometimes vague criteria) and assessment practices from state to state have often resulted in conflicting or confusing study results (Center, 1993; Clarizio & Higgins, 1989; Costello, 1993). Two studies reviewed in this chapter (Daley, et al., 1997; Saneda, 1993) include information which illustrates the heterogeneity of problem behavior in samples based on program placement.

**Other Methods.** Daley, et al. (1997) and Saneda (1993) found that a behavior rating scale, based upon statistically derived behavior traits, could be used to refine the categorical assignment of subjects in experimental groups (samples which were initially conceptualized as theoretically homogeneous were found to be actually quite heterogeneous). Dixon (1994) avoided the issue of group assignment entirely by using a single sample design, wherein differences in severity of reported problems were compared to cognitive performance.
Summary. This brief overview illustrates how defining and measuring behavior can be problematic. Although far from perfect, the use of standardized instruments which are based upon empirically derived dimensions of behavior appears to be preferable to categorical methods which are troubled by issues of definition and operationalization (e.g., Achenbach, 1995).

Statistically Derived Dimensions of Behavior

Descriptive and Theory Based Approaches. For centuries, descriptions of human behavior have been used to identify or classify individuals with special needs or problems (Kagin, 1968). Formal and reasonably scientific categorization of problem behaviors (based on observation) can be seen in the nineteenth century works of Phillipe Pinel, Jean Esquirol, and Emil Kraepelin (Hothersall, 1990). Such efforts were the forerunners of current descriptive categorization systems (e.g., American Psychiatric Association, 1994).

In the late nineteenth and early twentieth centuries, clinically developed theories based on individual observation and professional collaboration were the norm (e.g., Freud, 1953). Attempts to measure behavior based on these theories led to a state where “... hundreds of questionnaires were spawned on subjective clinical and occupational hunches” (Cattell, 1990, p. 101).

Factor Analysis. Seeking a more scientifically reliable approach, Cattell (1947) applied factor analytic techniques (the development of which he attributed to Spearman)
to behavior rating and questionnaire items. His efforts yielded a theory with statistically verifiable personality and abnormal behavior factors. Cattell (1990) wrote, “In this approach one first found the personality structure and then constructed scales for each verified factor” (p. 101).

Although far from universally accepted, the factor analytic approach to defining personality and behavior became fairly widespread (e.g., Achenbach, 1978, 1982, 1985; Eysenck & Eysenck, 1964; 1985; Vernon, 1964). Achenbach (1995) succinctly described the utility of statistical techniques:

Multivariate statistical methods can be used to identify groupings of problems far more systematically and rigorously than the clinical observations on which descriptive nosology has been based. These methods make it easy to take account of large numbers of potentially useful variables assessed in much larger samples of children than individual clinicians can evaluate. Using multivariate methods, we can thus derive syndromes from large samples chosen to be representative of populations… rather than being limited to particular clinical caseloads (p. 62).

Factor Derivation of Constructs. As noted in chapter one, factor analyses distinguishing broad groupings of behavior, which some designate as internalizing and externalizing, have frequently been reported (Eysenck, 1990; Eysenck & Eysenck, 1985, Achenbach, 1966). Eysenck (1990) emphasized that these dimensions are the final level of a hierarchy, in which lower order factors combine to yield higher order factors. On the lowest level, Eysenck explained, are individual actions or thoughts. Habitual actions or
thoughts make up the second level, and combine to yield third level traits. Finally, traits combine to yield fourth level dimensions. Eysenck stated it is "... widely agreed that a model for personality must be hierarchical" (1990, p. 244).

Using factor analyses, Cattell (1947) initially identified 12 abnormal behavior traits, which Eysenck (1990) has classified as third order factors (however, see Cattell (1990) for a criticism of Eysenck's application of factor analysis to behavior and personality theory and instruments). Since that seminal work, other researchers have reported that certain factors have been consistently found in multiple studies (Achenbach, 1985; Achenbach & Edelbrock, 1978; Quay, 1986). The process of refining these factors is illustrated in the next section through a summary of research pertinent to this study.

Achenbach, Conners, and Quay (1983) developed a checklist of items for 12 hypothesized behavior problem factors, or syndromes, which was then completed by 5,364 parents of children referred for mental health services in the United States. Ten core syndromes were derived from analysis of these and other behavior rating study results (Achenbach, et al., 1989). Although most syndromes were fairly consistent across age and gender, some were restricted to one sex or age group (6 to 11 years, or 12 to 16 years). For example, the 1986 version of the Teacher Report Form (TRF; Achenbach & Edelbrock, 1986) yields eight or nine of eleven syndrome scales, depending on age and gender. Six of these scales are consistent across age groups and gender.

Further refinement of the ten core syndromes was done using 8,542 ratings of instruments completed by parents, teachers, and the children themselves (Achenbach, 1995). Eight cross-informant core syndromes were derived from these data, and given

These eight syndromes were next analyzed using second-order principal factor analyses. The Withdrawn, Somatic Complaints, and Anxious/Depressed syndromes formed one distinct grouping, which Achenbach (1995) labeled Internalizing Problems. Delinquent Behavior and Aggressive Behavior formed a second grouping, which was labeled Externalizing Problems. The Attention Problems syndrome had a moderately high mean loading on the Externalizing Problems factor, but it was substantially lower than the mean loadings of the Delinquent and Aggressive Behavior syndromes, and so was not assigned by Achenbach to that factor. Social Problems and Thought Problems did not have consistently high loadings on either of the two largest higher order factors.

The Teacher's Report Form (TRF). The teacher ratings referred to in Achenbach (1995) were obtained using the TRF (Achenbach, 1991; Achenbach & Edelbrock, 1986), which is one of the most frequently used behavior rating instruments in educational settings (Martin, et al., 1995). The first version of this instrument was adapted from the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983), and published in standardized form in 1986 (Achenbach & Edelbrock, 1986). The Syndrome Scales of this instrument were derived from ratings on 1,700 clinically referred children, and normed on 1,100 non-referred children. The TRF was revised in 1991 with new norms through age 18 derived from ratings on 1,391 children (Achenbach, 1991).

Achenbach (1991) has stated that the 1991 TRF profile can be scored using pre-1991 procedures, since changes in the profile are small and "do not affect scoring" (p. 1).


Conclusion

Through much of the twentieth century, the intellectual ability of children with problem behavior was studied using traditional intelligence tests. Only in the last two decades have studies which examine the cognitive processes of such children from a theoretical perspective begun to emerge.

The PASS theory and the CAS have been shown to have potential for improving understanding of these processes and their relation to problem behavior. A trend linking low cognitive planning with high levels of problem behavior in both externalizing and internalizing areas is evident in a number of studies.
Statistically derived syndromes of problem behavior have also been systematically identified, refined, and quantified in recent decades. The TRF is one instrument which has been developed as a part of this research, and which has become widely used in practice (Martin, et al., 1995).
Subjects

Subjects were drawn from the population of students who were referred for special education evaluations in the Columbus, Ohio public school district between September, 1997 and January, 2000. Most special education multifactored evaluations in Columbus Public Schools include completion of the Teacher’s Report Form (TRF; Achenbach, 1991) and a measure of cognitive ability. Only students who were administered the Cognitive Assessment System (CAS; Naglieri & Das, 1997a) and TRF as part of their evaluation were selected for the sample. Permission to collect and use the data for this study was granted by the Columbus Public Schools on February, 2, 2000.

A minimum sample size of 150 subjects was sought for this study. Subject characteristics, including gender, age, race, academic achievement scores, special education program of referral, and program placement status were also collected from archival records.
Instruments – Cognitive Assessment System

Description

The CAS (Naglieri & Das, 1997a) is an individually administered standardized assessment instrument, which measures the Planning, Attention, Simultaneous, and Successive (PASS) cognitive processes of children ages five through seventeen years. The CAS is comprised of twelve subtests, three in each of the PASS scales. Subtest scores are scaled with a mean score of 10 and a standard deviation of 3, while PASS Scale and Full Scale standard scores have a mean of 100 and a standard deviation of 15. The CAS can be administered as a 12 subtest Standard Battery (three subtests per PASS Scale) or an eight subtest Basic Battery (two subtests per PASS Scale). All PASS Scale scores used in this study are based upon the Basic Battery, so only subtests contributing to the Basic Battery are described in the following sections.

CAS Planning Scale

Planning subtests on the CAS evaluate the student’s ability to select, use, and modify plans or strategies for the efficient completion of novel tasks. Self-monitoring the effectiveness of strategies used, and verbally describing the strategies are also aspects of good planning. Planning tasks on the CAS are timed measures; scores are derived from a combination of completion time and number of items correct.
Matching Numbers. This task requires the student to quickly find and underline pairs of numbers up to seven digits in length that are displayed in rows of similar but different numbers. The efficient and effective use of strategies results in a higher score. Strategies are observed and recorded by the examiner, who also asks the student to describe how they completed the items. Naglieri and Das (1988) and Naglieri, Prewett, and Bardos (1989) reported this task is related to other planning tasks.

Planned Codes. On this task, students are required to follow a key matching simple letter codes (OX, XX, OO, and XO) with the letters A through D. The student must quickly fill in the codes on pages where the letters are arranged in different patterns. No prescribed method of completion is given; instead children are encouraged to fill in the items any way they want. Again, the efficient and effective use of strategies results in a higher score. As with Matching Numbers, the examiner observes and records the strategies used, and asks the student to describe how the items were completed. Naglieri and Das (1997b) have described Planned Codes as a variation of similar coding tests devised and used since the 1920’s.

CAS Attention Scale

Attention subtests on the CAS are designed to evaluate the student’s ability to focus cognitive activity while ignoring or inhibiting distractions. Efficient, selective, and sustained focus on particular information is essential for satisfactory completion of these
timed items. Scores are based on number of items correctly completed (errors are subtracted from total items completed) and time required for task completion.

**Expressive Attention.** This task requires the student to name a quality about the stimulus presented (i.e. the color ink in which a color word is printed) while suppressing a more natural or automatic way of responding (i.e. reading the word itself). The task is similar to the Stroop test (Stroop, 1935), and has been shown in several studies to be related to other measures of attention (Naglieri, Braden, & Gottling, 1993; Naglieri & Das, 1988, 1997b).

**Number Detection.** This timed paper and pencil task requires the child to find and underline specific numbers on a page with rows of numbers, many of which are very similar to the target items. Naglieri and Das (1997b) have described Number Detection as “... similar to a multidimensional stimuli attention task” (p. 19) described by Schneider, Dumais, and Schiffrin (1984).

**CAS Simultaneous Scale**

This portion of the CAS requires the student to examine stimuli for patterns and inter-relatedness. The integration of separate stimuli into meaningful perceptual or conceptual wholes is the central aspect of simultaneous processing. Scores are based on number of items completed correctly.

**Nonverbal Matrices.** On this task, visual patterns of shapes or geometric designs that are inter-related through spatial or logical organization are presented with a piece
missing. The student must select from a field of six similar items the correct item which will complete the pattern. Naglieri and Das (1997b) have stated that matrices tasks have been used as measures of simultaneous processing "... in over 30 published papers" (p. 21).

**Verbal-Spatial Relations.** This task evaluates the students' comprehension of logical grammatical relationships. Items consist of six drawings with a question printed at the bottom of each page which is read by the examiner. The questions ask which picture exhibits a specific spatial arrangement. Only one picture will have the required qualities, although all six may be very similar. Student responses are required within a 30 second time limit. Luria's (1966, 1970, 1980, 1982) work served as the basis for the development of this task.

**CAS Successive Scale**

CAS Successive processing tasks are intended to evaluate the child's ability to maintain and comprehend the serial organization of information. All tasks involve verbal presentation of words or sentences where meaning can only be derived from the order of words.

**Word Series.** This subtest consists of series of up to nine unrelated words which are presented by the examiner verbally. The same nine words are used throughout the subtest so that the student does not have to rely heavily on short-term recall of novel information. The student must orally repeat the words in exactly the same order they are
presented. Luria (1966) used tasks similar to this when evaluating individuals with head trauma. Naglieri and Das (1997b) reported that word or number repetition tasks have been used in over 30 studies of successive processing.

**Sentence Repetition.** Sentences with limited semantic content are presented orally for the child to repeat back verbatim. Semantic content is decreased by the use of color words in place of nouns, verbs, and adjectives. Thus, only the sequence of the sentence’s words remains important. The development of this task is founded upon Luria’s (1966) discussion of the importance of successive processing in the serial organization of speech. Naglieri and Das (1997b) have cited several studies using versions of this task in the investigation of successive processes.

**CAS Standardization**

The CAS Standardization Edition was administered to a total of 3072 children, age 5 through 17 years, in 68 sites across the United States (Naglieri & Das, 1997b). The normative sample was derived from test results for 2200 of these children, and the other 872 participated in studies of reliability and validity. Demographic characteristics closely matching the United States population on gender, race, region, community setting, classroom placement, educational classification, and parental education are reported for the standardization sample (Naglieri & Das, 1997b).

CAS subtest raw score distributions for one year age intervals were normalized and converted to scaled scores with a mean of ten and a standard deviation of three.
Naglieri and Das (1997b) reported that minor irregularities in score progressions were “smoothed” (p. 42). PASS Scale standard score distributions were developed from summed subtest scaled scores in each scale, and the Full Scale score distribution is derived from the sum of all subtest scaled scores given (8 for the Basic Battery and 12 for the Standard Battery). Analyses of the distributions yielded no significant differences by age.

**CAS Validity**

**Construct Validity.** Construct validity refers to the extent to which a test instrument measures one or more hypothetical variables. CAS subtests and Scales are intended to measure PASS theoretical constructs. To test this, factor analytic techniques were applied to CAS standardization data (Naglieri & Das, 1997b). Confirmatory analyses by four age groups yielded Goodness-of-Fit (GFI) and Adjusted Goodness-of-Fit (AGFI) indices above .90. One, two, three, and four factor models were also analyzed by age groups. Statistically significant ($p < .01$ or $p < .05$) chi-square incremental improvement values were found for the four factor model for three age groups. A three factor model was best suited for the 11-13 year old age group, with planning and attention emerging as a single factor. Naglieri and Das (1997b) have acknowledged that these two areas are very closely related, but have also emphasized that their theoretical distinctiveness should not be ignored simply on the basis of factor solutions.
Several exploratory analysis techniques were also used to evaluate construct validity. Three or four factor models emerge as best solutions depending on age group; for some, the attention and planning factors again emerge as a single factor.

**Content Validity.** Content validity refers to the extent to which an instrument's items are representative of the variable which it is intended to measure. Naglieri and Das (1997b) described a process of task analysis combined with experimental examination in the development of CAS tasks. An emphasis was placed on keeping the theoretical basis for the CAS intact.

**Criterion-Related Validity.** Criterion-related validity is the degree to which the scores of a test instrument relate to outcome criteria, such as scores on instruments which measure the same or similar constructs, or the degree to which individual scores can forecast a criterion situation. One of the stated uses of the CAS is prediction of academic achievement. 1,600 children ages 5 to 17 were administered both the CAS and the Woodcock-Johnson Tests of Achievement – Revised (WJ-R; Woodcock & Johnson, 1989). Correlation values for CAS Standard Battery Full Scale (.61 to .73) and PASS Scale (.37 to .67) scores with WJ-R subtest and cluster scores were all significant (p < .01) for this sample.

Samples of mentally retarded (n = 80), learning disabled (n = 80), and regular education (n = 46) students were given the CAS, WJ-R, and WISC-III. Correlations between the WJ-R Skills cluster score and both CAS and WISC-III Full Scale scores are
similar across all three groups. Many other significant ($p < .05$) correlations between CAS, WJ-R, and WISC-III scores were also found. Greater detail of these and several other studies are reported by Naglieri and Das (1997b) and Naglieri (1999a).

Correlations between WJ-R and CAS scores for students with PASS Scale cognitive weaknesses were examined. CAS Simultaneous and Successive weaknesses were related to low scores on WJ-R Letter-Word Identification, Dictation, Word Attack, Reading Vocabulary, Passage Comprehension, and Proofing. Planning weaknesses were associated with low WJ-R Math Calculation, Dictation, and Basic Writing Skills. All four PASS Scale weaknesses were associated with low WJ-R Dictation and Proofing scores. Naglieri and Das (1997b) suggested these findings show that different PASS processes are related to levels of performance on academic tasks.

**CAS Reliability**

**Internal Consistency.** Internal consistency is measured using split half reliability, which refers to the degree of correspondence in a group of items, and test-retest reliability, which is the extent to which test instrument scores are consistent over time. A total test split-half internal reliability coefficient of .90 or above, and a subtest coefficient of .80 or above is considered desirable (Bracken, 1987).

Split-half reliability coefficients for CAS Simultaneous and Successive subtests (except Speech Rate) were calculated using the entire standardization sample. Test-retest reliability was used with the Planning and Attention subtests, and the Successive Scale
Speech Rate subtest. Test-retest reliability was used for these subtests because they all involve time. Mean corrected correlation coefficients for PASS Scale and Full Scale scores range from .84 (Basic Battery Attention Scale) to .96 (Standard Battery Full Scale). Mean subtest coefficients range from .75 (Matching Numbers) to .89 (Nonverbal Matrices and Figure Memory). Results are summarized by Naglieri and Das (1997b) as, "... consistent with what is typical for a test of cognitive abilities" (p. 44).

Test-retest reliability was evaluated for the entire CAS with a sample of 215 children from the standardization sample over a period of from 9 to 73 days. Averaged PASS Scale and Full Scale corrected stability coefficients range from .77 (Basic Battery Simultaneous Scale) to .91 (Standard Battery Full Scale). Average subtest coefficients range from .67 (Verbal Spatial Relations) to .80 (Planned Codes, Sentence Repetition).

Instruments - The Teacher's Report Form

Description

The Teacher Report Form (Achenbach, 1991; Achenbach & Edelbrock, 1986) is a behavior rating scale designed to obtain teachers’ perceptions of student behavior and emotional status (Achenbach, 1991). Its intended use is for descriptive purposes, rather than for categorization. The 1991 version of the TRF profile is used in this study, but standard scores were derived using pre-1991 procedures, a practice which Achenbach (1991) has stated is permissible, since the differences in results are small.
The TRF includes 113 statements about behavior from which the Syndrome, Composite, and Total Scale T scores are derived. Instructions state teachers are to consider the child's behavior over the previous two months, and then answer each item as "Not True" (a score of 0), "Somewhat or Sometimes True" (a score of 1), or "Very True or Often True" (a score of 2).

Item raw scores are summed by Syndrome Scale and converted to T scores. The number of items which make up the 1986 TRF Syndrome Scales may be as few as 6 (depending on age and gender) or as many as 39. Some items are included in more than one Syndrome Scale based on their factor loading; Achenbach & Edelbrock (1986) likened this to the association of certain physical symptoms with more than one disease. For the 1986 Syndrome Scales, the Anxious and Social Withdrawal Scales combine to form the Internalizing Composite. The Aggressive, Inattentive, Nervous-Overactive (boys and girls age 6-11), Delinquent (girls age 12-16), and Unpopular (girls age 12-16) form the Externalizing Composite. Scales with mixed factor loadings which do not contribute to either of these composites include Unpopular (boys age 6-16 and girls age 6-11), Self-Destructive, Obsessive-Compulsive (boys age 6-16), Immature (boys and girls age 12-16), and Depressed (girls age 6-16). All TRF items contribute to the Total Problems Composite score.

Achenbach and Edelbrock (1986) have recommended using the 89th percentile (a T score of 63) as the clinical cutoff score (differentiating between normal and abnormal scores) for the composite and Total Problem scores. The 98th percentile (a T score of 57
70) is the recommended clinical cutoff for the Syndrome Scales. Assignment of T scores to raw scores is discussed in the standardization section below.

TRF Syndrome Scales

The six 1986 TRF Syndrome Scales which are consistent across age and gender are Anxious, Social Withdrawal, Unpopular, Self-Destructive, Inattentive, and Aggressive. Scores on these Syndrome Scales are examined in this study. Each scale is briefly described in the next section. Correlations with 1991 TRF Syndrome Scales are provided (where available) to illustrate the consistency between the two sets of scales.

Anxious. Items in this Syndrome Scale include behaviors that are considered symptomatic of extreme anxiousness, such as being overly dependent on adults, excessive crying, or often expressing feelings of guilt. Achenbach (1991) reported that correlation coefficients between this scale and the 1991 Syndrome Scale, Anxious/Depressed, range from .92 to .99 (depending on age and gender).

Social Withdrawal. This scale includes items that reflect abnormal withdrawal from normal events, such as fears about attending school, showing an excessive preference for being alone, or not getting involved with others. This scale correlates from .95 to .98 with the 1991 Withdrawn Syndrome Scale.

Unpopular. Items contributing to this scale include behaviors such as not getting along with other students, getting into fights, or often getting teased by peers. This scale correlates between .83 and .98 with the 1991 Social Problems Syndrome Scale.
Self-Destructive. This scale includes items such as deliberately harming oneself, attempting suicide, destroys personal belongings, and eating or drinking non-food items. This scale does not have a 1991 Syndrome Scale correlate.

Inattentive. This scale includes items related to poor concentration, difficulty sustaining attention and difficulty sitting still or staying on task. This scale correlates between .97 and .99 with the 1991 Syndrome Scale, Attention Problems. Recent work (Achenbach, 1996) shows that the Attention Problems Syndrome Scale can be rescored into separate scales consisting of Inattention items and Hyperactivity-Impulsivity items. This suggests that the pre-1991 Inattentive Scale may be made up of more than one distinctly measurable construct.

Aggressive. This scale evaluates behaviors such as arguing, defiance, cruelty, and physical aggression. Correlations with the 1991 Syndrome Scale Aggressive Behavior are .99 for all age groups.

TRF Composite Scales

The TRF Internalizing and Externalizing Composite scores are also examined in this study. These scales are briefly described in this section.

Internalizing. Syndrome Scales used in this study which contribute to the Internalizing composite include Anxious and Social Withdrawal. The pre-1991 composite scale correlates from .95 to .97 with the 1991 Internalizing Problems Scale.
**Externalizing.** Syndrome Scales used in this study which contribute to the Externalizing composite include Inattentive and Aggressive. The pre-1991 composite scale correlates .93 to .95 with the 1991 Externalizing Problems Scale.

**TRF Standardization**

The TRF was developed along with other instruments as part of the large scale, exploratory process described in chapter two (e.g. Achenbach, 1991, 1995; Achenbach & Edelbrock, 1981, 1983, 1986). The Syndrome Scales of the 1986 TRF (Achenbach & Edelbrock, 1986) were derived from ratings on 1,700 clinically referred children, and normed on 1,100 non-referred children. The normative sample was developed using ratings completed by 665 teachers of students in grades one through ten from schools in three major American cities. The sample was 77 percent White, 23 percent Black, and had an equal number of males and females. Achenbach and Edelbrock (1986) did not provide information about whether the standardization sample was representative of the United States population. Norms were developed for four groups: boys age 6-11, boys age 12-16, girls age 6-11, and girls age 12-16.

The raw score distribution from the normative sample was used to assign standardized scores. All Syndrome Scale raw scores at or below the 69th percentile were assigned a \( T \) score of 55. This was intended to reduce overinterpretation of minor differences within the normal range of behavior (Achenbach & Edelbrock, 1986). Raw scores from the 69th to the 98th percentile were assigned \( T \) scores using the procedure
for normalized standard scores. Raw scores above the 98th percentile were assigned T score values up to 100 using equal intervals based on the number of possible remaining raw scores. The resulting distributions of T scores, therefore, have unequal intervals, since each Syndrome Scale has a different number of possible raw scores. Syndrome Scale standard deviations are also less than 10 (the norm for T scores), and their variance is unequal (heteroskedastic). Both of these issues may affect correlational analyses.

Composite T scores are based on the percentiles of the distribution of raw total scores in the normative sample up to the 98th percentile. A T score of 89 was assigned to the highest raw score obtained in the clinical sample (for each age and gender group). Raw scores from the 98th percentile to the highest raw score were assigned in equal intervals from 71 to 89. Raw scores above the highest score in the clinical sample were assigned T score values in equal intervals from 90 to 100.

TRF Validity

Construct Validity. Achenbach (1991) has stated that support for the construct validity of the TRF Syndrome and Composite scales is found in predictive validity studies which have been reported "... in over 100 published studies of the pre-1991 TRF scales" (p. 69). An extensive bibliography of research involving the TRF and related instruments has been compiled (Vignoe, Berube, & Achenbach, 1999).

Content Validity. A large pool of behavior statements relevant to the problem behavior of children was derived from a literature survey, case history studies, item
analyses, and feedback from parents and mental health workers (Achenbach, 1966, 1978; Achenbach & Edelbrock, 1983, 1986). This pool was reduced through successive studies and revisions to form the Child Behavior Checklist (CBCL; Achenbach, 1978). CBCL item scores for a sample of children referred for mental health services (n = 1300) and a demographically similar sample of non-referred children (n = 1300) showed that the referred children had significantly (p < .005) higher scores on all but two items (Achenbach & Edelbrock, 1981).

Many TRF items were taken directly from the CBCL, but some were added or modified to make them more suitable for teachers. TRF item scores were examined in the same manner as in Achenbach and Edelbrock (1981) using samples of 1100 referred and 1100 demographically similar non-referred children. Mean scores for all items except one were significantly higher (p < .005) for the referred group (Achenbach & Edelbrock, 1986). The TRF authors have stated this demonstrates that the items on the TRF relate to mental health concerns.

**Criterion-Related Validity.** The exploratory studies completed by Achenbach and Edelbrock (1981, 1986) indicate the TRF can discriminate between referred and non-referred samples of children for ages 6 to 16 years and for both sexes with a high degree of accuracy.
TRF Reliability

**Internal Consistency.** The TRF Syndrome Scales were derived from principle component analyses of the correlations among the items. The internal consistency of each scale is the basis for grouping them together. Split-half reliability coefficients were not provided by Achenbach and Edelbrock (1986). Test-retest reliability coefficients were determined using samples (different age and gender groups, total n = 117) with a median test-retest interval of 15 days. A median Total Problems Score correlation of .89 was reported. Two month (r = .74), and Four month (r = .68) test-retest intervals were also studied using a sample of 21 boys age 6-11 (Achenbach & Edelbrock, 1986).

**Interrater Reliability.** Achenbach and Edelbrock (1986) reported a median reliability coefficient of .57 for ratings of children in special education programs (total n = 660) completed by teachers and teacher aides working in the same environment. Teachers tended to rate students less favorably than aides, but the mean difference was small, representing only a two point difference between Total Problems T scores.

**Procedures**

**Sample Characteristics**

A description of sample characteristics and variables, including age, gender, race, program of referral, placement, and academic achievement, will be presented and
Descriptive statistics for PASS Scale and TRF Composite and Syndrome Scale scores, including mean, standard deviation, minimum, and maximum scores, will be presented and examined. Relationships between CAS and TRF scores and demographic variables will be examined using correlational analysis.

Analysis of Research Questions

The research questions posed in chapter one are listed in the next section. Question one will be answered through analysis of a correlation matrix for CAS PASS and TRF Syndrome Scale and Composite scores.

Questions two through nine will be answered using repeated measures multivariate Analysis of Variance (MANOVA) of CAS PASS Scale mean score profiles by low and high TRF Syndrome and Composite Scale groups. Group composition will be determined using cutscores. Several cutscores will be applied to each TRF Scale to examine PASS Scale profiles for trends which might not be evident if only a single cutoff score were used. Three analyses (one for each cut score) will be completed for each of questions two through nine.

For questions ten through fourteen, subjects with significant cognitive weaknesses on the CAS will be identified using ipsative analysis. Each PASS Scale score will be compared to the mean of all four PASS scale scores for each subject. Values to determine significant differences will be obtained from Table D.3 in the CAS Administration and Scoring Manual (Naglieri & Das 1997a, p. 198). Scores that are
significantly lower than the mean of all four PASS Scale scores, and which are also below a cut score of 85 (one standard deviation below the standard score distribution mean), will be identified as a significant cognitive weakness (CW). For each group (CW in Planning, CW in Attention, CW in Simultaneous, CW in Successive, and No CW), TRF Syndrome Scale score profiles will be examined for differences using a repeated measures Multivariate Analysis of Variance (MANOVA) design. The statistical significance of all analyses’ results will be reported using two probability values, $p < .05$ and $p < .01$.

**Research Questions**

1. What are the correlational relationships between CAS PASS Scale, TRF Syndrome Scale, and TRF Composite scores?

2. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Anxious Syndrome Scale scores than for students with high TRF Anxious scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?
3. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Social Withdrawal Syndrome Scale scores than for students with high TRF Social Withdrawal scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

4. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Unpopular Syndrome Scale scores than for students with high TRF Unpopular scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

5. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Self-Destructive Syndrome Scale scores than for students with high TRF Self-Destructive scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?
6. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Inattentive Syndrome Scale scores than for students with high TRF Inattentive scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

7. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Aggressive Syndrome Scale scores than for students with high TRF Aggressive scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

8. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Internalizing Composite scores than for students with high TRF Internalizing scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?
9. Are CAS Planning, Attention, Simultaneous, or Successive scores different for students with low TRF Externalizing Composite scores than for students with high TRF Externalizing scores:
   a. Using a TRF cut score of 60 (one standard deviation above the mean)?
   b. Using a TRF cut score of 65 (1.5 standard deviations above the mean)?
   c. Using a TRF cut score of 70 (two standard deviations above the mean)?

10. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Planning on the CAS?

11. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Attention on the CAS?

12. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Simultaneous on the CAS?

13. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with a significant cognitive weakness in Successive on the CAS?

14. Does the TRF yield a consistent pattern of Syndrome Scale scores for subjects with no significant cognitive weaknesses on the CAS?
CHAPTER 4

RESULTS

Introduction

This chapter summarizes the results of data analyses which were completed to examine the relationship between CAS PASS cognitive processes and problem behavior in children, measured using the TRF. In the first section, data collection procedures and demographic variables are described. In the second section, academic achievement, CAS, and TRF score data are summarized. The third section addresses the analyses of the research questions stated in chapter three. A conclusion summarizes results and their relationship to the hypotheses under study.

Descriptive Data

Data Collection. A survey of school psychologists in the Columbus Public School district identified 12 individuals who had administered the CAS as part of one or more multi-factored evaluations (MFE) between September, 1997 and January, 2000. Archival
records of evaluations completed by these individuals were then searched for useable data. Complete CAS and TRF scores were found for 190 students. CAS Basic Battery scores were obtained from test protocols or from MFE reports. TRF scores were obtained from computer scored printouts. Demographic data for each subject were gathered from computer database records maintained by the school district.

Seven subjects were deleted from the sample because of the questionable reliability of some of their test scores. The one subject in the sample identified as autistic was also eliminated in order to simplify description and analyses by special education program. This left a remaining total sample of 182 subjects, drawn from 31 different schools. This sample size exceeded the target goal of 150 subjects set in chapter three.

**Demographic Variables.** The Columbus Public School district uses a set of codes to record student race. Codes for subjects in this sample include: White (not Hispanic), Black (not Hispanic), Hispanic, Asian, and Other. Race and gender information is summarized in Table 4.1, which shows the sample was about two thirds male, and approximately half Black and half White.

The age range for the students in the sample was six years, one month, to sixteen years, ten months. The mean age was ten years, six months, with a standard deviation of two years, 7.7 months. The median age was ten years, three months.

Table 4.2 provides special education program referral and eligibility status for the sample. Each subject was referred for one of three suspected handicapping conditions: Emotional Disturbance (ED), Specific Learning Disability (SLD), or Developmental
Handicap (DH). As shown in the table, nearly 50 percent of the students in the sample were referred for suspected SLD. ED and DH referred groups were similar in size.

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
<th>Asian</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Female</td>
<td>33 (18.1)</td>
<td>27 (14.8)</td>
<td>1 (0.5)</td>
<td>1 (0.5)</td>
<td>62 (34.1)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>49 (26.9)</td>
<td>65 (35.7)</td>
<td>4 (2.2)</td>
<td>1 (0.5)</td>
<td>120 (65.9)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>82 (45.1)</td>
<td>92 (50.6)</td>
<td>5 (2.8)</td>
<td>2 (1.0)</td>
<td>182 (100.0)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1: Race and Gender.

Special education program eligibility decisions in Columbus Public Schools are made by a team consisting of at least a school psychologist, a special education program consultant, and a representative of the student’s school, usually the teacher. Table 4.2 shows that over 65 percent of the students in this sample were determined to be eligible for special education services.
<table>
<thead>
<tr>
<th>Program</th>
<th>Eligible</th>
<th>Ineligible</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Emotionally Disturbed</td>
<td>33 (18.1)</td>
<td>16 (8.8)</td>
<td>49 (26.9)</td>
</tr>
<tr>
<td>Learning Disability</td>
<td>58 (31.9)</td>
<td>30 (16.5)</td>
<td>88 (48.4)</td>
</tr>
<tr>
<td>Developmental Handicap</td>
<td>29 (15.9)</td>
<td>16 (8.8)</td>
<td>45 (24.7)</td>
</tr>
<tr>
<td>Total</td>
<td>120 (65.9)</td>
<td>62 (34.1)</td>
<td>182 (100.0)</td>
</tr>
</tbody>
</table>

Table 4.2: Special Education Program of Referral and Eligibility Status.

Summary of Test Score Data

**Academic Achievement.** Standard scores from individually administered tests of academic achievement, which were given as part of the multifactored evaluation, were obtained for 181 subjects in the sample. Of these, 111 subjects were administered portions of the Wechsler Individual Achievement Test (WIAT; The Psychological Corporation, 1992). The Woodcock-Johnson Tests of Achievement – Revised (WJ-R, Woodcock & Johnson, 1989) was administered to another 71 subjects in the sample.
One subject was administered both of these tests. The WIAT and WJ-R both yield subtest and composite standard scores with a mean of 100 and a standard deviation of 15.

WIAT scores are summarized in Table 4.3, and WJ-R scores in Table 4.4. The number of subjects with a score in each subtest or composite area is shown in the tables. All mean achievement scores for the sample, except WJ-R Applied Problems, were more than one standard deviation below the standard score mean of 100.

<table>
<thead>
<tr>
<th>WIAT Variable</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Reading</td>
<td>111</td>
<td>80.64</td>
<td>11.2</td>
<td>58</td>
<td>112</td>
</tr>
<tr>
<td>Math Reasoning</td>
<td>111</td>
<td>82.10</td>
<td>11.4</td>
<td>58</td>
<td>109</td>
</tr>
<tr>
<td>Spelling</td>
<td>110</td>
<td>78.93</td>
<td>12.3</td>
<td>53</td>
<td>118</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>102</td>
<td>77.60</td>
<td>10.5</td>
<td>50</td>
<td>110</td>
</tr>
<tr>
<td>Numerical Operations</td>
<td>109</td>
<td>77.16</td>
<td>13.6</td>
<td>53</td>
<td>109</td>
</tr>
<tr>
<td>Written Expression</td>
<td>67</td>
<td>75.73</td>
<td>11.6</td>
<td>59</td>
<td>106</td>
</tr>
<tr>
<td>Reading Composite</td>
<td>90</td>
<td>75.81</td>
<td>11.7</td>
<td>52</td>
<td>112</td>
</tr>
<tr>
<td>Math Composite</td>
<td>95</td>
<td>76.56</td>
<td>13.0</td>
<td>53</td>
<td>109</td>
</tr>
<tr>
<td>Writing Composite</td>
<td>65</td>
<td>73.98</td>
<td>13.0</td>
<td>53</td>
<td>115</td>
</tr>
</tbody>
</table>

Table 4.3: WIAT Academic Achievement Standard Scores.
<table>
<thead>
<tr>
<th>WJ-R Variable</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Word</td>
<td>71</td>
<td>76.41</td>
<td>14.2</td>
<td>45</td>
<td>107</td>
</tr>
<tr>
<td>Passage Completion</td>
<td>71</td>
<td>81.23</td>
<td>12.7</td>
<td>43</td>
<td>118</td>
</tr>
<tr>
<td>Math Calculation</td>
<td>71</td>
<td>79.34</td>
<td>18.9</td>
<td>44</td>
<td>132</td>
</tr>
<tr>
<td>Applied Problems</td>
<td>71</td>
<td>87.08</td>
<td>14.9</td>
<td>53</td>
<td>125</td>
</tr>
<tr>
<td>Dictation</td>
<td>72</td>
<td>74.15</td>
<td>12.1</td>
<td>28</td>
<td>99</td>
</tr>
<tr>
<td>Writing Samples</td>
<td>71</td>
<td>77.94</td>
<td>15.9</td>
<td>41</td>
<td>119</td>
</tr>
<tr>
<td>Broad Reading</td>
<td>71</td>
<td>76.61</td>
<td>13.6</td>
<td>47</td>
<td>111</td>
</tr>
<tr>
<td>Broad Math</td>
<td>71</td>
<td>79.89</td>
<td>18.3</td>
<td>38</td>
<td>125</td>
</tr>
<tr>
<td>Broad Written</td>
<td>71</td>
<td>74.68</td>
<td>13.4</td>
<td>45</td>
<td>103</td>
</tr>
</tbody>
</table>

Table 4.4: WJ-R Academic Achievement Standard Scores.
CAS and TRF Scores. Table 4.5 summarizes CAS PASS and Full Scale standard scores for the sample. All mean CAS Scale scores were at least two thirds of a standard deviation below the standard score mean of 100. The mean Planning Scale score was distinctly lower than the means of the other three PASS Scales.

<table>
<thead>
<tr>
<th>CAS Scale</th>
<th>M</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>82.63</td>
<td>12.7</td>
<td>47</td>
<td>129</td>
</tr>
<tr>
<td>Attention</td>
<td>89.49</td>
<td>13.4</td>
<td>48</td>
<td>124</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>88.42</td>
<td>11.5</td>
<td>58</td>
<td>117</td>
</tr>
<tr>
<td>Successive</td>
<td>88.89</td>
<td>14.0</td>
<td>49</td>
<td>121</td>
</tr>
<tr>
<td>CAS Full Scale</td>
<td>82.31</td>
<td>13.2</td>
<td>40</td>
<td>118</td>
</tr>
</tbody>
</table>

Table 4.5: CAS Standard Scores (n = 182).
Table 4.6 summarizes TRF Scale T scores for the sample. All mean TRF T scores except the Anxious Syndrome Scale and the Internalizing Composite were at least one standard deviation above the T score mean of 50. TRF Scale standard deviations vary between 5.3 on the Anxious Scale and 11.3 on the Aggressive Scale. This resulted in large inequalities in TRF Scale variance. The range of T scores also varies greatly on the TRF Syndrome Scales, as shown by minimum and maximum values in Table 4.6.

<table>
<thead>
<tr>
<th>TRF Scale</th>
<th>M</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxious</td>
<td>58.50</td>
<td>5.3</td>
<td>55</td>
<td>81</td>
</tr>
<tr>
<td>Social Withdrawal</td>
<td>63.97</td>
<td>8.2</td>
<td>55</td>
<td>91</td>
</tr>
<tr>
<td>Unpopular</td>
<td>63.81</td>
<td>8.7</td>
<td>55</td>
<td>97</td>
</tr>
<tr>
<td>Self-Destructive</td>
<td>63.54</td>
<td>7.6</td>
<td>55</td>
<td>90</td>
</tr>
<tr>
<td>Inattentive</td>
<td>67.32</td>
<td>9.1</td>
<td>55</td>
<td>97</td>
</tr>
<tr>
<td>Aggressive</td>
<td>65.70</td>
<td>11.3</td>
<td>55</td>
<td>95</td>
</tr>
<tr>
<td>Internalizing</td>
<td>59.36</td>
<td>8.2</td>
<td>42</td>
<td>83</td>
</tr>
<tr>
<td>Externalizing</td>
<td>65.56</td>
<td>9.6</td>
<td>39</td>
<td>88</td>
</tr>
<tr>
<td>Total Problems</td>
<td>64.63</td>
<td>9.5</td>
<td>33</td>
<td>91</td>
</tr>
</tbody>
</table>

Table 4.6: TRF T Scores (n = 182).
Comparison of Variables

CAS and Demographic Variables. Pearson correlations between CAS scores and age, provided in Table 4.7, were not statistically significant. Point biserial correlations between CAS scores, gender, and race (Black/White) are also shown in Table 4.7. Only the Black and White subjects were included in the analysis by race since they make up over 95 percent of the sample. Correlations by race were not significant.

<table>
<thead>
<tr>
<th>CAS Scale</th>
<th>Age (n=182)</th>
<th>Gender (n=182)</th>
<th>Race (n=174)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>-.07</td>
<td>.16*</td>
<td>.05</td>
</tr>
<tr>
<td>Attention</td>
<td>-.03</td>
<td>.09</td>
<td>.03</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>.03</td>
<td>.02</td>
<td>.15</td>
</tr>
<tr>
<td>Successive</td>
<td>.13</td>
<td>.01</td>
<td>.40</td>
</tr>
<tr>
<td>Full Scale</td>
<td>.03</td>
<td>.09</td>
<td>.00</td>
</tr>
</tbody>
</table>

Table 4.7: Intercorrelation of CAS Scores with Age, Gender, and Race (Black and White).
* p < .05
A statistically significant correlation between gender and CAS Planning is shown in Table 4.7. The mean Planning score for males in the sample ($n = 120$) was 81.20; for females ($n = 62$) the mean was 85.40. An independent samples $t$ test comparing mean Planning scores by gender yielded a $t$ value of 2.13, which is significant at $p < .05$. This indicates that, on average, males in the sample earned lower CAS Planning Scale scores than females.

In Table 4.8, mean CAS PASS Scale scores and standard deviations are shown by special education program of referral and eligibility status. Mean PASS score profiles by program and eligibility are also graphed in Figure 4.1, which shows that Planning scores were lowest for all groups. The DH Eligible group had the lowest scores compared to other groups in all four PASS areas. Planning was low in the DH Ineligible group as well, but the other PASS areas were much higher in comparison to the DH Eligible group. The ED Eligible group had lower mean Planning and Attention scores relative to Simultaneous and Successive, but Attention was the highest score for the ED Ineligible group. ED and LD Ineligible group profiles are very similar. LD Eligible and Ineligible profiles also appear to be quite similar.

**CAS and Achievement.** Correlations between academic achievement and CAS scores are provided in Tables 4.9 and 4.10. Both WJ-R and WIAT math subtest and composite scores correlated significantly with all CAS PASS Scale and Full Scale scores. CAS Planning and Successive correlated significantly with WJ-R tests of reading, but WIAT reading tests correlated more with CAS Simultaneous and Successive. CAS
Planning was significantly correlated with all WJ-R scores, but with relatively few WIAT scales. WIAT Written Expression and CAS scores show the weakest relationship.

<table>
<thead>
<tr>
<th>Program</th>
<th>n</th>
<th>M (SD)</th>
<th>M (SD)</th>
<th>M (SD)</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED Eligible</td>
<td>33</td>
<td>83.39</td>
<td>86.97</td>
<td>89.58</td>
<td>92.18</td>
</tr>
<tr>
<td>ED Ineligible</td>
<td>16</td>
<td>85.87</td>
<td>94.88</td>
<td>88.81</td>
<td>92.19</td>
</tr>
<tr>
<td>LD Eligible</td>
<td>58</td>
<td>85.36</td>
<td>94.72</td>
<td>93.31</td>
<td>90.43</td>
</tr>
<tr>
<td>LD Ineligible</td>
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<td>93.80</td>
<td>90.90</td>
<td>93.23</td>
</tr>
<tr>
<td>DH Eligible</td>
<td>29</td>
<td>73.45</td>
<td>77.24</td>
<td>77.66</td>
<td>75.21</td>
</tr>
<tr>
<td>DH Ineligible</td>
<td>16</td>
<td>77.25</td>
<td>84.44</td>
<td>82.75</td>
<td>89.88</td>
</tr>
<tr>
<td>Total Eligible</td>
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<td>81.94</td>
<td>88.37</td>
<td>88.50</td>
<td>87.23</td>
</tr>
<tr>
<td>Total Ineligible</td>
<td>62</td>
<td>83.97</td>
<td>91.66</td>
<td>88.26</td>
<td>92.10</td>
</tr>
</tbody>
</table>

Table 4.8: Mean CAS PASS Scale Scores and Standard Deviations (in parentheses) by Special Education Program (ED = Emotional Disturbance; LD = Learning Disability; DH = Developmental Handicap).
Figure 4.1: Mean CAS PASS Scale Standard Scores by Program and Eligibility Status (PLN = Planning; ATT = Attention; SIM = Simultaneous; SUC = Successive).
Table 4.9: Intercorrelation of WJ-R Academic Achievement and CAS Scores (PLN = Planning; ATT = Attention; SIM = Simultaneous; SUC = Successive; FS = Full Scale).

<table>
<thead>
<tr>
<th>WJ-R Variable</th>
<th>n</th>
<th>PLN</th>
<th>ATT</th>
<th>SIM</th>
<th>SUC</th>
<th>FS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter-Word</td>
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<td>.39**</td>
<td>.16</td>
<td>.10</td>
<td>.34**</td>
<td>.37**</td>
</tr>
<tr>
<td>Passage Completion</td>
<td>71</td>
<td>.36**</td>
<td>.01</td>
<td>.20</td>
<td>.29*</td>
<td>.32**</td>
</tr>
<tr>
<td>Math Calculation</td>
<td>71</td>
<td>.54**</td>
<td>.32**</td>
<td>.42**</td>
<td>.34**</td>
<td>.57**</td>
</tr>
<tr>
<td>Applied Problems</td>
<td>71</td>
<td>.54**</td>
<td>.45**</td>
<td>.50**</td>
<td>.50**</td>
<td>.72**</td>
</tr>
<tr>
<td>Dictation</td>
<td>72</td>
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<td>.31**</td>
<td>.22</td>
<td>.28*</td>
<td>.45**</td>
</tr>
<tr>
<td>Writing Samples</td>
<td>71</td>
<td>.28*</td>
<td>.14</td>
<td>-.01</td>
<td>.16</td>
<td>.21</td>
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<tr>
<td>Broad Reading</td>
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<td>.16</td>
<td>.33**</td>
<td>.36**</td>
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<tr>
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<td>.61**</td>
<td>.42**</td>
<td>.50**</td>
<td>.47**</td>
<td>.72**</td>
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<td>Broad Written Language</td>
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<td>.23</td>
<td>.05</td>
<td>.18</td>
<td>.30**</td>
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</table>

* p < .05. ** p < .01.
<table>
<thead>
<tr>
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<th>n</th>
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<th>ATT</th>
<th>SIM</th>
<th>SUC</th>
<th>FS</th>
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</thead>
<tbody>
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<td>.09</td>
<td>.28**</td>
<td>.18</td>
<td>.23*</td>
</tr>
<tr>
<td>Math Reasoning</td>
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<td>.42**</td>
<td>.45**</td>
<td>.61**</td>
<td>.37**</td>
<td>.63**</td>
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<tr>
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<td>.23*</td>
<td>.20*</td>
<td>.29**</td>
<td>.22*</td>
<td>.31**</td>
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<td>.16</td>
<td>.32**</td>
<td>.25**</td>
<td>.30**</td>
</tr>
<tr>
<td>Numerical Operations</td>
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<td>.50**</td>
<td>.38**</td>
<td>.53**</td>
<td>.23*</td>
<td>.55**</td>
</tr>
<tr>
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<td>.11</td>
<td>.12</td>
<td>.22</td>
<td>.23</td>
</tr>
<tr>
<td>Reading Composite</td>
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<td>.17</td>
<td>.15</td>
<td>.32**</td>
<td>.25*</td>
<td>.31**</td>
</tr>
<tr>
<td>Math Composite</td>
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<td>.48**</td>
<td>.49**</td>
<td>.60**</td>
<td>.31**</td>
<td>.64**</td>
</tr>
<tr>
<td>Writing Composite</td>
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<td>.22</td>
<td>.24*</td>
<td>.24</td>
</tr>
</tbody>
</table>

Table 4.10: Intercorrelation of WIAT Academic Achievement and CAS Scores (PLN = Planning; ATT = Attention; SIM = Simultaneous; SUC = Successive; FS = Full Scale). * p < .05. ** p < .01.
**TRF and Demographic Variables.** Pearson correlations between TRF Syndrome and Composite scores and age, provided in Table 4.11, were not statistically significant. Point biserial correlations between TRF scores, gender, and race (Black/White) are also shown in Table 4.11. A significant correlation between gender and the TRF Social Withdrawal Syndrome Scale was found. The mean Social Withdrawal T Score for males in the sample was 65 (standard deviation 8.8). For females, the mean was 61.98 (6.6 standard deviation). A comparison of these means using the t test yielded a t value of -2.4 (df = 180), which is significant at p < .01. This indicates that, on average, males in the sample had higher TRF Social Withdrawal scores than females.

Table 4.11 also shows a significant correlation between race (Black and White groups only) and the TRF Aggressive Syndrome Scale. A comparison of mean scores (White: m = 63.96, sd: 10.6; Black: m = 67.9, sd: 11.7) yielded a t test value of -2.29 (df = 172) which is statistically significant at p < .05. This indicates that, on average, White subjects had lower Aggressive T scores than Black subjects in the sample.

In Table 4.12, mean TRF Syndrome Scale and Composite T scores and standard deviations are shown by special education program of referral and eligibility status. Large differences in standard deviations can be seen between program areas for several of the scales. Mean Syndrome Scale T score relationships with program and eligibility are also graphed in Figure 4.2. The graph shows that mean Anxious Scale T scores were lowest across all program categories. An examination of TRF score frequencies for the entire sample showed that over 55 percent of subjects in the sample had an Anxious T score of 55, and that the distribution of Anxious Scale scores had the smallest range. The
percentage of subjects with a T score of 55 on the other TRF Syndrome Scales ranged from 31 percent (Aggressive) to 9 percent (Inattentive). These differences show why the mean Anxious T score was lower than the other TRF Scale mean scores.

<table>
<thead>
<tr>
<th>TRF Scale</th>
<th>Age (n=182)</th>
<th>Gender (n=182)</th>
<th>Race (n=174)</th>
</tr>
</thead>
<tbody>
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<td>Anxious</td>
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<td>.06</td>
<td>.03</td>
</tr>
<tr>
<td>Social Withdrawal</td>
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<td>.17*</td>
<td>.00</td>
</tr>
<tr>
<td>Unpopular</td>
<td>.04</td>
<td>.09</td>
<td>.03</td>
</tr>
<tr>
<td>Self-Destructive</td>
<td>-.02</td>
<td>.03</td>
<td>.06</td>
</tr>
<tr>
<td>Inattentive</td>
<td>.04</td>
<td>.10</td>
<td>.11</td>
</tr>
<tr>
<td>Aggressive</td>
<td>.00</td>
<td>.08</td>
<td>.17*</td>
</tr>
<tr>
<td>Internalizing</td>
<td>.06</td>
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</tr>
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<td>Externalizing</td>
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<td>.11</td>
<td>.14</td>
</tr>
<tr>
<td>Total Problems</td>
<td>.00</td>
<td>.07</td>
<td>.11</td>
</tr>
</tbody>
</table>

Table 4.11: Intercorrelation of TRF Scores with Age, Gender, and Race (Black and White).
* p < .05.
TRF Scale profiles for the ED categories, shown in Figure 4.2, deviate noticeably from profiles for the LD and DH categories. This is especially true of the Aggressive and Externalizing Scales. This suggests that subjects in this sample who were referred for suspected emotional disturbance manifested higher levels of problem behavior than subjects referred for suspected learning disabilities or developmental handicaps.

**TRF and Achievement.** Pearson correlations between academic achievement and TRF scores are provided in Tables 4.13 and 4.14. There were few significant correlations between TRF scores and WJ-R variables, but TRF Inattentive correlated significantly with all WIAT variables. All but two TRF Scales (Anxious and Social Withdrawal) correlated significantly with the WIAT Math Composite. All but one of the significant correlations (WJ-R Writing Samples and TRF Aggressive) found were negative.
<table>
<thead>
<tr>
<th>Program</th>
<th>n</th>
<th>M (SD)</th>
<th>M (SD)</th>
<th>M (SD)</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED Eligible</td>
<td>33</td>
<td>61.61 (7.0)</td>
<td>66.36 (8.0)</td>
<td>69.06 (9.4)</td>
<td>70.55 (9.4)</td>
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<tr>
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<td>16</td>
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<td>66.25 (5.1)</td>
<td>65.88 (6.1)</td>
<td>68.00 (5.7)</td>
</tr>
<tr>
<td>LD Eligible</td>
<td>58</td>
<td>58.43 (5.0)</td>
<td>63.40 (8.5)</td>
<td>62.00 (8.9)</td>
<td>61.59 (5.4)</td>
</tr>
<tr>
<td>LD Ineligible</td>
<td>30</td>
<td>56.90 (4.3)</td>
<td>61.17 (8.2)</td>
<td>62.03 (8.1)</td>
<td>59.07 (5.6)</td>
</tr>
<tr>
<td>DH Eligible</td>
<td>29</td>
<td>58.28 (4.7)</td>
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<td>63.59 (8.1)</td>
<td>63.17 (6.9)</td>
</tr>
<tr>
<td>DH Ineligible</td>
<td>16</td>
<td>57.69 (4.3)</td>
<td>61.13 (7.1)</td>
<td>61.19 (6.1)</td>
<td>60.75 (5.0)</td>
</tr>
<tr>
<td>Total Eligible</td>
<td>120</td>
<td>59.27 (5.7)</td>
<td>64.75 (8.5)</td>
<td>64.32 (9.3)</td>
<td>64.43 (8.0)</td>
</tr>
<tr>
<td>Total Ineligible</td>
<td>62</td>
<td>57.02 (4.2)</td>
<td>62.47 (7.5)</td>
<td>62.81 (7.3)</td>
<td>61.81 (6.6)</td>
</tr>
</tbody>
</table>

Table 4.12: Mean TRF Scale T Scores and Standard Deviations (in parentheses) by Special Education Program (ED = Emotional Disturbance; LD = Learning Disability; DH = Developmental Handicap).
<table>
<thead>
<tr>
<th>Program</th>
<th>n</th>
<th>Inattentive M (SD)</th>
<th>Aggressive M (SD)</th>
<th>Internalizing M (SD)</th>
<th>Externalizing M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED Eligible</td>
<td>33</td>
<td>72.00 (11.3)</td>
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<td>63.91 (7.0)</td>
<td>75.00 (9.1)</td>
</tr>
<tr>
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<td>78.69 (9.7)</td>
<td>60.44 (4.8)</td>
<td>73.87 (6.7)</td>
</tr>
<tr>
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<td>58.33 (8.7)</td>
<td>62.50 (7.7)</td>
</tr>
<tr>
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<td>64.43 (8.2)</td>
<td>59.50 (5.8)</td>
<td>56.00 (8.5)</td>
<td>60.03 (7.8)</td>
</tr>
<tr>
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<td>68.41 (7.5)</td>
<td>62.21 (7.7)</td>
<td>60.76 (6.8)</td>
<td>64.14 (7.0)</td>
</tr>
<tr>
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<td>65.63 (7.9)</td>
<td>60.50 (8.5)</td>
<td>56.38 (8.6)</td>
<td>61.81 (8.1)</td>
</tr>
<tr>
<td>Total Eligible</td>
<td>120</td>
<td>68.21 (9.7)</td>
<td>66.21 (11.3)</td>
<td>60.45 (8.1)</td>
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<td>65.60 (7.6)</td>
<td>64.71 (11.2)</td>
<td>57.24 (7.9)</td>
<td>64.06 (9.5)</td>
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</table>
Figure 4.2: Mean TRF Syndrome Scale T Scores by Program and Eligibility Status (ANX = Anxious; S/W = Social Withdrawal; UNP = Unpopular; S/D = Self-Destructive; INA = Inattentive; AGG = Aggressive; INT = Internalizing Composite; EXT = Externalizing Composite).
<table>
<thead>
<tr>
<th>WJ-R Variable</th>
<th>n</th>
<th>ANX</th>
<th>S/W</th>
<th>UNP</th>
<th>S/D</th>
<th>INA</th>
<th>AGG</th>
<th>INT</th>
<th>EXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter-Word</td>
<td>71</td>
<td>-0.04</td>
<td>-0.01</td>
<td>0.20</td>
<td>0.12</td>
<td>0.08</td>
<td>0.17</td>
<td>0.03</td>
<td>0.10</td>
</tr>
<tr>
<td>Passage Completion</td>
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<td>-0.05</td>
<td>0.06</td>
<td>0.09</td>
<td>0.03</td>
<td>0.02</td>
<td>0.05</td>
<td>0.07</td>
<td>-0.01</td>
</tr>
<tr>
<td>Math Calculation</td>
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<td>-0.06</td>
<td>-0.01</td>
<td>0.10</td>
<td>-0.20</td>
<td>0.05</td>
<td>-0.10</td>
<td>-0.02</td>
</tr>
<tr>
<td>Applied Problems</td>
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<td>-0.13</td>
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<td>-0.26*</td>
<td>-0.02</td>
<td>-0.10</td>
<td>-0.12</td>
</tr>
<tr>
<td>Dictation</td>
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<td>-0.19</td>
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</tr>
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<td>-0.09</td>
<td>0.31**</td>
<td>-0.07</td>
<td>0.18</td>
</tr>
<tr>
<td>Broad Reading</td>
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<td>0.02</td>
<td>0.14</td>
<td>0.07</td>
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<td>-0.08</td>
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<td>0.12</td>
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<td>0.23</td>
<td>-0.21</td>
<td>0.10</td>
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Table 4.13: Intercorrelation of WJ-R Academic Achievement and TRF Scores (ANX = Anxious; S/W = Social Withdrawal; UNP = Unpopular; S/D = Self-Destructive; INA = Inattentive; AGG = Aggressive; INT = Internalizing Composite; EXT = Externalizing Composite).

* p < .05.  ** p < .01.
<table>
<thead>
<tr>
<th>WIAT Variable</th>
<th>n</th>
<th>ANX</th>
<th>S/W</th>
<th>UNP</th>
<th>S/D</th>
<th>INA</th>
<th>AGG</th>
<th>INT</th>
<th>EXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Reading</td>
<td>111</td>
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<td>-.07</td>
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<td>-.13</td>
<td>-.20*</td>
<td>-.13</td>
<td>-.12</td>
<td>-.18</td>
</tr>
<tr>
<td>Math Reasoning</td>
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<td>-.12</td>
<td>-.15</td>
<td>-.08</td>
<td>-.15</td>
<td>-.25**</td>
<td>-.06</td>
<td>-.23*</td>
<td>-.16</td>
</tr>
<tr>
<td>Spelling</td>
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<td>-.08</td>
<td>-.17</td>
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<td>-.30**</td>
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<td>-.22*</td>
<td>-.22*</td>
</tr>
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<td>-.19</td>
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<td>-.27**</td>
<td>-.19</td>
<td>-.20</td>
<td>-.25*</td>
</tr>
<tr>
<td>Math Composite</td>
<td>95</td>
<td>-.16</td>
<td>-.31**</td>
<td>-.20*</td>
<td>-.27**</td>
<td>-.39**</td>
<td>-.24*</td>
<td>-.38**</td>
<td>-.38**</td>
</tr>
<tr>
<td>Writing Composite</td>
<td>65</td>
<td>-.07</td>
<td>-.16</td>
<td>-.09</td>
<td>-.18</td>
<td>-.30*</td>
<td>-.11</td>
<td>-.22</td>
<td>-.23</td>
</tr>
</tbody>
</table>

Table 4.14: Intercorrelation of WIAT Academic Achievement and TRF Scores. (ANX = Anxious; S/W = Social Withdrawal; UNP = Unpopular; S/D = Self-Destructive; INA = Inattentive; AGG = Aggressive; INT = Internalizing Composite; EXT = Externalizing Composite).

* p < .05.   ** p < .01.
Analysis of Research Questions

Overview. The analysis results described in the next section were used to examine the hypotheses postulated in chapter one. First, it was hypothesized that students with high externalizing TRF Syndrome Scale (e.g., Inattentive, Aggressive) or Composite scores would have low scores in either Planning and/or Attention on the CAS. Secondly, it was hypothesized that students with high internalizing scores (e.g., TRF Anxious, Social Withdrawal, and Internalizing Composite) would have low scores in CAS Planning.

Question One. Correlational relationships between CAS PASS Scale and TRF Syndrome and Composite Scale scores were examined to answer the first research question. Correlations between these variables are provided in Tables 4.15, 4.16, and 4.17, each of which include both uncorrected Pearson correlation coefficients and coefficient estimates after correction for restriction in range (sample score distributions that are smaller than the population distribution). Corrections were accomplished using the formula from Cohen and Cohen (1983) shown in Figure 4.3, where \( r_{xy} \) is the uncorrected correlation coefficient, \( s_{xy} \) is the standard deviation for the sample, and \( s_{x} \) is the standard deviation for the population distribution (15 for the CAS standard scores, and 10 for the TRF T scores). An example of the transformation formula used to perform these corrections is shown in Appendix A.

All CAS PASS Scale uncorrected and corrected correlations, which are provided in Table 4.15, were statistically significant at \( p < .01 \). The uncorrected coefficients were
compared to mean CAS Basic Battery intercorrelations from the standardization sample, which were found in Naglieri and Das (1997b; Table A.11, p. 140). The correlation values were comparable, indicating that the intercorrelational relationships among CAS PASS Scale scores for this sample were similar to the standardization sample.

Table 4.16 shows that all of the TRF Scale uncorrected and corrected correlations were also significantly intercorrelated at $p < .01$. The uncorrected TRF correlations were compared to mean correlations from the referred samples of children used to develop the TRF (Achenbach & Edelbrock, 1986; Appendix D, p. 164-167). The similarity between the two indicates the correlational relationships among TRF scores for this sample were comparable to the samples used in Achenbach and Edelbrock (1986).

\[
\tilde{r}_{XY} = \frac{r_{XY} \left( sd_X / sd_X \right)}{\sqrt{1 + r_{XY}^2 \left( \frac{sd^2_X}{sd^2_X} - 1 \right)}}
\]

Figure 4.3: Correction Formula for Pearson Correlations of Sample Score Distributions With Restricted Range (from Cohen and Cohen, 1983, p. 70).
Table 4.15: CAS Pearson Correlation Coefficients. Correlations above the diagonal are corrected for restriction in range using formula in Figure 4.3. Uncorrected correlations are shown below the diagonal.

** \( p < .01 \)

<table>
<thead>
<tr>
<th></th>
<th>Planning</th>
<th>Attention</th>
<th>Simultaneous</th>
<th>Successive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>.72**</td>
<td>.50**</td>
<td>.29**</td>
<td></td>
</tr>
<tr>
<td>Attention</td>
<td></td>
<td>.62**</td>
<td>.52**</td>
<td>.33**</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>.35**</td>
<td></td>
<td>.39**</td>
<td>.37**</td>
</tr>
<tr>
<td>Successive</td>
<td>.23**</td>
<td>.28**</td>
<td>.28**</td>
<td></td>
</tr>
</tbody>
</table>

Uncorrected and corrected correlation coefficients between CAS PASS Scale scores and TRF Syndrome Scale and Composite scores are provided in Table 4.17. All statistically significant correlations were negative, indicating an inverse relationship between scores was present. Significant correlations between CAS Planning and TRF Self-Destructive, Inattentive, and both Composite Scales were found. Significant correlations between CAS Attention and TRF Social Withdrawal, Self-Destructive, Inattentive, and both Composite Scales were also found. CAS Simultaneous correlated
Table 4.16: TRF Pearson Correlation Coefficients. Correlations above the diagonal are corrected for restriction in range using formula in Figure 4.3. Uncorrected correlations are shown below the diagonal (ANX = Anxious; S/W = Social Withdrawal; UNP = Unpopular; S/D = Self-Destructive; INA = Inattentive; AGG = Aggressive; INT = Internalizing Composite; EXT = Externalizing Composite).

<table>
<thead>
<tr>
<th></th>
<th>ANX</th>
<th>S/W</th>
<th>UNP</th>
<th>S/D</th>
<th>INA</th>
<th>AGG</th>
<th>INT</th>
<th>EXT</th>
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<tbody>
<tr>
<td>ANX</td>
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<td>.64**</td>
<td>.72**</td>
<td>.55**</td>
<td>.33**</td>
<td>.93**</td>
<td>.55**</td>
<td></td>
</tr>
<tr>
<td>S/W</td>
<td>.44**</td>
<td></td>
<td>.56**</td>
<td>.60**</td>
<td>.63**</td>
<td>.27**</td>
<td>.91**</td>
<td>.51**</td>
</tr>
<tr>
<td>UNP</td>
<td>.36**</td>
<td>.44**</td>
<td></td>
<td>.76**</td>
<td>.66**</td>
<td>.61**</td>
<td>.63**</td>
<td>.73**</td>
</tr>
<tr>
<td>S/D</td>
<td>.39**</td>
<td>.43**</td>
<td>.61**</td>
<td></td>
<td>.72**</td>
<td>.72**</td>
<td>.69**</td>
<td>.81**</td>
</tr>
<tr>
<td>INA</td>
<td>.30**</td>
<td>.52**</td>
<td>.57**</td>
<td>.59**</td>
<td></td>
<td>.50**</td>
<td>.64**</td>
<td>.76**</td>
</tr>
<tr>
<td>AGG</td>
<td>.21**</td>
<td>.25**</td>
<td>.60**</td>
<td>.66**</td>
<td>.51**</td>
<td></td>
<td>.37**</td>
<td>.91**</td>
</tr>
<tr>
<td>INT</td>
<td>.75**</td>
<td>.82**</td>
<td>.50**</td>
<td>.51**</td>
<td>.53**</td>
<td>.34**</td>
<td></td>
<td>.60**</td>
</tr>
<tr>
<td>EXT</td>
<td>.32**</td>
<td>.42**</td>
<td>.66**</td>
<td>.71**</td>
<td>.72**</td>
<td>.92**</td>
<td>.51**</td>
<td></td>
</tr>
</tbody>
</table>

significantly with TRF Anxious, Inattentive, and the Internalizing Composite Scale. CAS Successive correlated significantly with TRF Anxious and the Internalizing Composite Scale.
The correlational relationships found between CAS Planning and Attention and the TRF Inattentive and Externalizing Scales provide some support for the first hypothesis, which states that high TRF Externalizing scores would be related to low CAS Planning and/or Attention. The absence of a significant correlational relationship between TRF Aggressive and CAS Planning or Attention, however, supports the null of this hypothesis.

The relationship found between CAS Planning and the TRF Internalizing Composite provides some support for the second hypothesis, which states that high Internalizing scores would be related to low CAS Planning. The absence of a significant correlational relationship between TRF Anxious or Social Withdrawal and CAS Planning, however, supports the null of this hypothesis.

The relationships found between CAS Attention and the TRF Social Withdrawal and Internalizing Scales suggests that Attention is associated with internalizing problem behaviors. Significant correlational relationships between CAS Simultaneous and Successive and the TRF Anxious and Internalizing Scales suggests these cognitive processes may be associated with internalizing problem behaviors as well. Simultaneous may also be associated with externalizing (e.g., Inattentive) problem behaviors.
<table>
<thead>
<tr>
<th></th>
<th>Planning</th>
<th>Attention</th>
<th>Simultaneous</th>
<th>Successive</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANX</td>
<td>-.04 (-.08)</td>
<td>-.07 (-.14)</td>
<td>-.09 (-.21**)</td>
<td>-.12 (-.24**)</td>
</tr>
<tr>
<td>S/W</td>
<td>-.13 (-.19)</td>
<td>-.17* (-.23**)</td>
<td>-.05 (-.08)</td>
<td>-.09 (-.12)</td>
</tr>
<tr>
<td>UNP</td>
<td>-.10 (-.14)</td>
<td>-.10 (-.13)</td>
<td>-.04 (-.06)</td>
<td>.03 (.03)</td>
</tr>
<tr>
<td>S/D</td>
<td>-.12 (-.19*)</td>
<td>-.15* (-.21**)</td>
<td>-.06 (-.11)</td>
<td>.00 (.00)</td>
</tr>
<tr>
<td>INA</td>
<td>-.32** (-.40**)</td>
<td>-.28** (-.34**)</td>
<td>-.14 (-.20*)</td>
<td>-.07 (-.08)</td>
</tr>
<tr>
<td>AGG</td>
<td>-.08 (-.09)</td>
<td>-.04 (-.04)</td>
<td>.05 (.05)</td>
<td>.13 (.12)</td>
</tr>
<tr>
<td>INT</td>
<td>-.14* (-.21**)</td>
<td>-.15* (-.20*)</td>
<td>-.10 (-.16*)</td>
<td>-.15* (-.19*)</td>
</tr>
<tr>
<td>EXT</td>
<td>-.20** (-.24**)</td>
<td>-.14 (-.16*)</td>
<td>-.04 (-.05)</td>
<td>.04 (.05)</td>
</tr>
</tbody>
</table>

Table 4.17: CAS and TRF Pearson Correlation Coefficients. Correlations in parentheses are corrected for restriction in range using formula in Figure 4.3. (ANX = Anxious; S/W = Social Withdrawal; UNP = Unpopular; S/D = Self-Destructive; INA = Inattentive; AGG = Aggressive; INT = Internalizing Composite; EXT = Externalizing Composite).

* p < .05. ** p < .01.

The TRF Unpopular and Self-Destructive Syndrome Scales have been identified by Achenbach and Edelbrock (1986) as neither internalizing or externalizing, but as mixed. The relationship found to exist between CAS Planning and Attention and TRF Self-Destructive suggests that these cognitive processes are involved in behaviors measured by this scale as well.
In summary, correlational data provide some support for the first hypothesis in this study; that low Planning and Attention are associated with high externalizing behaviors. Limited support for the second hypothesis, that low Planning is associated with internalizing behaviors, was also found. The additional correlational relationships found indicate that all CAS PASS processes are involved in different ways with aspects of problem behavior.

**Testing of Assumptions for Remaining Analyses.** Multivariate analysis assumptions were tested for each variable included in the multivariate analyses for the remaining research questions. Findings for each assumption are summarized in this section.

The independence of observations assumption was upheld, as each subject in the sample was administered the CAS individually; TRF protocols were typically completed by teachers independently.

Skewness and kurtosis were examined to test the assumption that observations on the dependent variables were normally distributed. Values for all PASS Scale distributions were less than one. TRF Anxious, Unpopular, and Inattentive Syndrome Scale distributions were found to be positively skewed, with values greater than one. Kurtosis values for the Anxious and Unpopular scales were also greater than one, indicating the scores in these distributions cluster more and have longer tails than a normal distribution. However, all TRF Syndrome Scale $T$ score distributions are skewed, since raw scores at or below the 69th percentile are assigned a $T$ score value of 55, and raw scores above the 98th percentile are assigned $T$ score values between 71 and 100 in
as many increments as there are remaining raw scores (above the 98th percentile) on a scale (Achenbach & Edelbrock, 1986). Stevens (1996), however, has reported that the effects of kurtosis on level of significance tend to be slight.

Homogeneity of the dependent variable covariance matrices was assessed using the Box (1949) test. Box’s $M$ values in four of the 25 multivariate analyses completed were statistically significant, indicating the likelihood that the covariance matrices in those four analyses were heterogenous. In two of these cases, the largest variance was associated with the smallest group size, indicating $F$ values may be liberal, resulting in false rejection of the null hypothesis too often. In one case, the larger variance was associated with the largest group size, indicating $F$ values in that analysis may be conservative. In the fourth case, group sizes were roughly equal. The $F$ statistic is robust against heterogeneous variances when group sizes are approximately equal (Stevens, 1996). Each of these four cases is discussed individually in the appropriate sections of this chapter.

Sphericity of the covariance matrices was tested using the Greenhouse-Geisser (1959) $\varepsilon$ statistic. A Greenhouse-Geisser $\varepsilon$ value of 1 is ideal, while a value equal to or less than $1/k-1$ (where $k$ is the number of levels in the dependent variable) would indicate the $F$ values obtained from analysis were positively biased, resulting in false rejection of the null hypothesis too often. Greenhouse-Geisser $\varepsilon$ values for the PASS variable were consistently within the range of .88 to .89 in all analyses, indicating sphericity was within acceptable parameters.
Overview of Profile Analysis. Profile analysis was used as part of the process for answering research questions two through fourteen. Profile analysis is a specific application of a repeated measures multivariate analysis design (Stevens, 1996). It involves the comparison of two or more groups on a battery of test scores. For questions two through nine, profiles of PASS Scale scores were compared for subjects grouped by low and high TRF scores. For questions ten through fourteen, profiles of TRF Syndrome Scale T scores were compared for subjects grouped by CAS cognitive weaknesses.

Three questions are asked in profile analysis. The first concerns whether the profile of mean scores for two or more groups are parallel. Parallel profiles imply that one group scored uniformly better than another on all variables. If profiles are not parallel, there is a group by variable interaction effect.

The second question in profile analysis asks: if the profiles are parallel, are the treatment levels equal, or coincident? If profiles are coincident, then differences by group can be considered due to error. If profiles are not coincident, one group scored differently than another on one or more of the dependent variables.

The third question in profile analysis examines whether the profiles are level. If they are, then the means on all variables are equal to the same constant. Unequal means reveal on which variables subjects scored differently by group.

Analysis of Questions Two Through Nine. For each analysis used to answer these questions, the total sample was divided into low and high two groups using cut scores (T scores of 60, 65, and 70 were used) applied to the TRF Syndrome and Composite Scales. Data were then analyzed using a repeated measures, multivariate Analysis of Variance.
(MANOVA) design, with one within-subjects dependent variable (PASS) having four levels (Planning, Attention, Simultaneous, and Successive), and one between-subjects independent variable (low and high TRF Scale groups). The repeated measures MANOVA procedure was completed three times for each TRF Scale, once for each cutscore. Within-subjects contrasts were examined using an average effect and adjacent differences within the levels of the dependent variable, which is the proper design for profile analysis. Profile analyses were conducted to determine whether CAS PASS Scale mean score profiles are affected by changes in TRF Scale scores. Multivariate main and interaction effects are reported in the next section, which is followed by univariate findings and descriptive analysis for each of questions two through nine.

Main and Interaction Effects. Multivariate main effect values for the PASS variable and interaction effects between PASS and each Syndrome Scale are provided in Table 4.18. The main effect for the PASS variable was shown to be statistically significant with all TRF Syndrome and Composite Scales at all three cutscores. This indicates that, in all analyses, the levels of the dependent variable (PASS) were significantly different. An examination of mean PASS Scale scores for the entire sample showed that Planning is comparatively lower than Attention, Simultaneous, or Successive. This may account for some of the difference in the main effect.

No statistically significant multivariate interaction effects were found. This indicates that the multivariate main effect of the PASS variable was not dependent on group assignment using any TRF Syndrome Scale or Composite score with any of the three cutscores.
The multivariate interaction statistic is used to answer question one in profile analysis. If the $F$ value for the interaction effect is significant (i.e., there is a significant group by variable interaction), parallelism is rejected. Hence, in all analyses, the hypothesis that PASS profiles are parallel across TRF groups is tenable.

In one instance, the multivariate results should be viewed with caution. When the 70 cutscore was used with the TRF Anxious Scale, the high group had an $n$ of eight. Maxwell and Delaney (1990) recommend against using the multivariate approach when $n$ is less than the number of levels in a within-subjects variable + 10, which, in these analyses was 14.

**Question Two.** For this question, CAS PASS Scale score profiles for subjects with low TRF Anxious Syndrome Scale $T$ scores were compared to PASS profiles of subjects with high Anxious Scale scores. Assignment of subjects to high or low groups was determined by whether their Anxious $T$ scores fell above or below the cutscore. Table 4.19 shows that a significant ($p < .01$) univariate within-subjects effects of the PASS variable was found when the 60 and 65 cutscores were used.

Unlike multivariate analyses, univariate tests do not take into account the differences on all variables jointly; therefore, the absence of a significant univariate effect (e.g., the PASS variable using the 70 cutscore) indicates the multivariate comparison may involve complexities undetected at the univariate level. Pairwise comparisons of PASS Scale scores based on estimated marginal means showed that the mean difference between Planning and each of the other three PASS Scales was significant ($p < .001$) when the 60 cutscore was used. The mean difference between
<table>
<thead>
<tr>
<th>Effect</th>
<th>60 Cutscore Wilks' $\lambda$</th>
<th>F</th>
<th>65 Cutscore Wilks' $\lambda$</th>
<th>F</th>
<th>70 Cutscore Wilks' $\lambda$</th>
<th>F</th>
</tr>
</thead>
<tbody>
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<td>PASS (ANX)</td>
<td>0.74</td>
<td>20.54**</td>
<td>0.87</td>
<td>8.77**</td>
<td>0.96</td>
<td>2.80*</td>
</tr>
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<td>PASS x ANX</td>
<td>0.99</td>
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<td>0.98</td>
<td>1.54</td>
<td>0.99</td>
<td>0.62</td>
</tr>
<tr>
<td>PASS (S/W)</td>
<td>0.75</td>
<td>20.01**</td>
<td>0.72</td>
<td>22.57**</td>
<td>0.79</td>
<td>15.78**</td>
</tr>
<tr>
<td>PASS x S/W</td>
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<td>0.64</td>
<td>0.97</td>
<td>1.88</td>
<td>0.97</td>
<td>2.18</td>
</tr>
<tr>
<td>PASS (UNP)</td>
<td>0.72</td>
<td>22.99**</td>
<td>0.72</td>
<td>23.66**</td>
<td>0.78</td>
<td>16.73**</td>
</tr>
<tr>
<td>PASS x UNP</td>
<td>0.98</td>
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<td>0.98</td>
<td>1.37</td>
<td>0.99</td>
<td>0.86</td>
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<td>0.71</td>
<td>23.86**</td>
<td>0.80</td>
<td>14.99**</td>
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<td>0.99</td>
<td>0.83</td>
<td>0.99</td>
<td>0.62</td>
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<tr>
<td>PASS (INA)</td>
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<td>0.96</td>
<td>2.26</td>
</tr>
<tr>
<td>PASS (AGG)</td>
<td>0.72</td>
<td>23.27**</td>
<td>0.70</td>
<td>25.45**</td>
<td>0.72</td>
<td>23.33**</td>
</tr>
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<td>0.98</td>
<td>1.53</td>
<td>0.98</td>
<td>1.07</td>
</tr>
<tr>
<td>PASS (INT)</td>
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<td>8.91**</td>
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<tr>
<td>PASS x INT</td>
<td>0.99</td>
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<td>23.07**</td>
</tr>
<tr>
<td>PASS x EXT</td>
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<td>0.38</td>
<td>0.98</td>
<td>1.30</td>
<td>0.98</td>
<td>1.45</td>
</tr>
</tbody>
</table>

* $p < .05$.  ** $p < .01$. 102
Planning and Attention was significant \((p < .001)\) with the 65 cutscore, but there were no significant pairwise differences at the 70 cutscore. One way Analysis of Variance (ANOVA) also revealed a significant \((p < .05)\) between-subjects effect of CAS Simultaneous when the 65 cutscore was used.

The univariate between-subjects test of the independent variable (in this case, Anxious) is used to answer the second question in profile analysis. A significant value indicates the hypothesis of coincidence is rejected (i.e., the groups did not score the same on each level of the PASS variable). A non-significant \(F\) value indicates the profiles are coincident. Table 4.19 shows there were no statistically significant between-subjects effects at any of the three cutscores, which indicates the hypothesis of coincidence is tenable when subjects were grouped using cutscores with the TRF Anxious Scale.

The third question in profile analysis is answered using the within-subject contrasts for the interaction effect (i.e., PASS x Anxious). If one or more \(F\) values are significant, the hypothesis of equal variable means is rejected. Contrasts are shown in Table 4.19. No values were statistically significant, indicating the hypothesis of equal variable means is also tenable for this data. Therefore, since all three profile analysis hypotheses are plausible when subjects were grouped using cutscores with the TRF Anxious Scale, CAS PASS Scale profile differences that exist can be considered due to error. This indicates that the secondary hypothesis in this study, that students with high internalizing scores (in this instance, on the TRF Anxious Scale) will have low scores in Planning, was not supported by this analysis.
<table>
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<th>ANX65</th>
<th>ANX70</th>
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<td></td>
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<td></td>
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<td>1.12</td>
<td>1.79</td>
<td>2.05</td>
</tr>
<tr>
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<td>(343.81)</td>
<td>(342.54)</td>
<td>(342.06)</td>
</tr>
<tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>PASS</td>
<td>3</td>
<td>14.08**</td>
<td>5.43**</td>
<td>1.87</td>
</tr>
<tr>
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<td>.22</td>
<td>1.91</td>
<td>.67</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
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<td>.26</td>
<td>.24</td>
<td>.62</td>
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<tr>
<td>Level 2 vs. Level 3</td>
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<td>.08</td>
<td>2.14</td>
<td>.26</td>
</tr>
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<td>Level 3 vs. Level 4</td>
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<td>.35</td>
<td>.03</td>
<td>1.20</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(108.19)</td>
<td>(107.19)</td>
<td>(107.92)</td>
</tr>
</tbody>
</table>

Table 4.19: Analysis of Variance and Contrast Effects for CAS PASS and TRF Anxious (ANX60 = 60 cutscore; ANX65 = 65 cutscore; ANX70 = 70 cutscore). Values enclosed in parentheses represent mean square errors. **p < .01.
Figure 4.4: PASS Scale Means by TRF Anxious Scale Cutscore Groups (PLN = Planning; ATT = Attention; SIM = Simultaneous; SUC = Successive).

Mean PASS Scale scores by TRF Anxious cutscore groups are graphed in Figure 4.4. The PASS Score profiles for Low Anxious groups at all three cutscores are virtually indistinguishable, and clearly illustrate the low mean Planning score, relative to Attention, Simultaneous, and Successive, for the total sample. The high Anxious group profiles, however, are distinctive; CAS Successive mean scores show a clear decrease as TRF Anxious scores rise. The high Anxious group PASS profile is most distinctive when
the 70 cutscore was used, but this group was very small (n = 8). The change in Planning scores for high Anxious groups does not show a clear trend that would indicate support for the hypothesis that low Planning is associated with high scores on the Anxious Scale.

**Question Three.** The third research question continues the examination of relationships between cognitive processes and internalizing problems through comparison of CAS PASS Scale scores with low and high groups on the TRF Social Withdrawal Syndrome Scale. Results in Table 4.20 show significant (p < .01) univariate within-subjects effects of the PASS variable at all cutscores. A significant (p < .05) between-subjects effect of Social Withdrawal was found when using the 65 cutscore. This effect indicates the PASS profiles are not coincident at that cutscore.

The within-subjects contrasts in Table 4.20 show that, at the 65 cutscore, the difference between Level 2 and Level 3 (Attention and Simultaneous) was significant (p < .05). This confirms that the variable means are not equal, indicating the differences in the subjects' scores on Attention and Simultaneous were not due to chance. PASS Scale profiles are graphed in Figure 4.5, which shows that the mean CAS Attention score dropped drastically between low and high Social Withdrawal groups at the 65 cutscore, while Simultaneous scores stayed relatively the same. This illustrates the unequal variable means for these scales. One way ANOVA also revealed a significant (p < .01) between-subjects effect of CAS Attention when the 65 and 70 cutscores were used.

The Social Withdrawal groups had unequal covariance matrices when the 70 cutscore was used, Box's $M = 20.55; F(10, 23381) = 1.97, p < .05$. Examination of group
variance showed that the larger variance was associated with the small group (high Social Withdrawal, \( n = 40 \)). This indicates that the actual alpha level was greater than the chosen level for significance in this analysis.

Figure 4.5 also shows that mean Planning scores decreased between low and high Social Withdrawal groups consistently at all cutscores, while Simultaneous and Successive scores showed no consistent pattern. This decrease suggests there is some support in the data for the hypothesis that high Social Withdrawal scores are associated with low Planning scores. However, there is considerable support for concluding that there is a relationship between low CAS Attention and high Social Withdrawal scores.
<table>
<thead>
<tr>
<th>Source</th>
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<th>S/W60</th>
<th>S/W65</th>
<th>S/W70</th>
</tr>
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<tbody>
<tr>
<td><strong>Between subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Withdrawal</td>
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<td>2.16</td>
<td>4.46*</td>
<td>2.66</td>
</tr>
<tr>
<td>Error (within cells)</td>
<td>180</td>
<td>(341.85)</td>
<td>(337.60)</td>
<td>(340.93)</td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>3</td>
<td>13.74**</td>
<td>16.10**</td>
<td>12.24**</td>
</tr>
<tr>
<td>PASS x Social Withdrawal</td>
<td>3</td>
<td>.45</td>
<td>1.57</td>
<td>1.93</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>1</td>
<td>1.76</td>
<td>1.90</td>
<td>1.90</td>
</tr>
<tr>
<td>Level 2 vs. Level 3</td>
<td>1</td>
<td>.18</td>
<td>5.38*</td>
<td>6.46**</td>
</tr>
<tr>
<td>Level 3 vs. Level 4</td>
<td>1</td>
<td>.12</td>
<td>1.14</td>
<td>.71</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(108.06)</td>
<td>(107.39)</td>
<td>(107.18)</td>
</tr>
</tbody>
</table>

Table 4.20: Analysis of Variance and Contrast Effects for CAS PASS and TRF Social Withdrawal (S/W60 = cutscore of 60; S/W65 = cutscore of 65; S/W70 = cutscore of 70). Values enclosed in parentheses represent mean square errors. * p < .05. ** p < .01.
Question Four. This question examines CAS PASS Scale score profiles for TRF Unpopular Scale low and high groups using the three cutscores. Table 4.21 shows the univariate $F$ values for the within-subjects PASS variable were again significant ($p < .01$) at all cutscores. Between-subjects effects and within-subjects contrasts were not significant at any cutscore, however, indicating the profile analysis hypotheses of
parallelism, coincidence of profiles, and equality of variable means are plausible for these comparisons. Profile differences, therefore, are most likely due to error or chance.

The high and low Unpopular groups had unequal covariance matrices when the 65 cutscore was used, Box's $M = 19.19; F(10, 93249) = 1.87, p < .05$. Examination of group variance showed that the larger variance was associated with the large group (low Unpopular, $n = 114$). This indicates that the actual alpha level was smaller than the chosen level for significance in this analysis.

When the 60 cutscore was used, one way ANOVA revealed significant ($p < .05$) between-subjects effects of CAS Planning and Attention. Low and High Unpopular group PASS Scale means are provided in Figure 4.6. Mean Planning scores in the high Unpopular groups were practically indistinguishable, but they were clearly lower than mean Planning scores in the low Unpopular groups. Likewise, mean Attention scores in the high Unpopular groups were lower than Attention scores in the low Unpopular groups. Mean Simultaneous scores did not change appreciably between groups, and mean Successive scores actually rose from low to high groups. In summary, these results suggest there is a relationship between high Unpopular scores and low Planning and Attention. As noted previously, the Unpopular Scale includes a mix of internalizing and externalizing behaviors, according to the test authors (Achenbach & Edelbrock, 1986). The construct is distinct enough, however, to show a relationship to the cognitive processes of Planning and Attention.
<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>UNP60</th>
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<th>UNP70</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between subjects</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unpopular</td>
<td>1</td>
<td>2.95</td>
<td>.39</td>
<td>.25</td>
</tr>
<tr>
<td>Error</td>
<td>180</td>
<td>(340.37)</td>
<td>(345.20)</td>
<td>(345.47)</td>
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<tr>
<td><strong>Within subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>3</td>
<td>15.56**</td>
<td>17.26**</td>
<td>12.92**</td>
</tr>
<tr>
<td>PASS x Unpopular</td>
<td>3</td>
<td>1.79</td>
<td>1.88</td>
<td>1.17</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
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<td>.04</td>
<td>.08</td>
<td>.27</td>
</tr>
<tr>
<td>Level 2 vs. Level 3</td>
<td>1</td>
<td>2.82</td>
<td>2.14</td>
<td>.88</td>
</tr>
<tr>
<td>Level 3 vs. Level 4</td>
<td>1</td>
<td>.06</td>
<td>.40</td>
<td>.72</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(107.26)</td>
<td>(107.21)</td>
<td>(107.63)</td>
</tr>
</tbody>
</table>

Table 4.21: Analysis of Variance and Contrast Effects for CAS PASS and TRF Unpopular (UNP60 = cutscore of 60; UNP65 = cutscore of 65; UNP70 = cutscore of 70). Values enclosed in parentheses represent mean square errors. **p < .01.
Figure 4.6: PASS Scale Means by TRF Unpopular Scale Cutscore Groups (PLN = Planning; ATT = Attention; SIM = Simultaneous; SUC = Successive).

**Question Five.** Mean PASS Scale score profiles were compared to low and high groups using the TRF Self-Destructive Syndrome Scale for this question. Table 4.22 shows significant ($p < .01$) within-subjects effects for the PASS variable at all cutscores, and for the within-subjects interaction effect at the 60 cutscore ($p < .05$). Between-subjects effects and within-subjects contrasts were not significant at any cutscore,
however, indicating the profile analysis hypotheses are plausible. PASS profile
differences between low and high Self-Destructive Scale groups are likely due to error or
chance.

PASS Scale profiles graphed in Figure 4.7 show little difference between mean
Planning, Attention or Simultaneous scores for the low Self-Destructive groups.
Planning and Attention scores were slightly lower in the high groups. Simultaneous
scores remained basically the same across groups, and Successive scores showed no
distinctive pattern. Like the Unpopular Scale, the Self-Destructive Scale is a mixture of
internalizing and externalizing behaviors, according to the test authors. Therefore, the
limited support provided by this analysis of a hypothetical relationship between the TRF
Self-Destructive Scale and CAS Planning or Attention is understandable.
<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>S/D60</th>
<th>S/D65</th>
<th>S/D70</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Destructive</td>
<td>1</td>
<td>.22</td>
<td>1.82</td>
<td>.40</td>
</tr>
<tr>
<td>Error</td>
<td>180</td>
<td>(345.54)</td>
<td>(342.49)</td>
<td>(345.20)</td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>3</td>
<td>15.86**</td>
<td>16.92**</td>
<td>11.43**</td>
</tr>
<tr>
<td>PASS x Self-Destructive</td>
<td>3</td>
<td>2.61*</td>
<td>.90</td>
<td>.79</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>1</td>
<td>.50</td>
<td>.00</td>
<td>.38</td>
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<tr>
<td>Level 2 vs. Level 3</td>
<td>1</td>
<td>.16</td>
<td>1.98</td>
<td>.25</td>
</tr>
<tr>
<td>Level 3 vs. Level 4</td>
<td>1</td>
<td>2.64</td>
<td>.18</td>
<td>.93</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(106.78)</td>
<td>(107.79)</td>
<td>(107.86)</td>
</tr>
</tbody>
</table>

Table 4.22: Analysis of Variance and Contrast Effects for CAS PASS and TRF Self-Destructive (S/D60 = cutscore of 60; S/D65 = cutscore of 65; S/D70 = cutscore of 70). Values enclosed in parentheses represent mean square errors. * p < .05. ** p < .01.
Question Six. PASS Scale score profiles were compared for low and high TRF Inattentive groups for this question. Table 4.23 shows significant (p < .01) within-subjects effects for the PASS variable at all cutscores, and for the within-subjects interaction effect at the 70 cutscore (p < .05). Between-subjects effects were significant at the 60 and 70 cutscores. However, within-subjects contrasts were not significant.
Therefore, profile analysis hypotheses for parallelism and equal variable means are supported, but the profiles are not coincident (i.e., the groups did not score the same on each variable).

Support for this conclusion was gained from one way ANOVA. Significant ($p < .01$) between subjects effects of Planning were found using all cutscores, and for Attention at the 60 and 70 cutscores ($p < .01$). Significant ($p < .01$) ANOVA between subjects effects of Simultaneous and Successive were also found when the 60 cutscore was used.

Profiles are illustrated in Figure 4.8. The PASS profile for the low Inattentive group at the 60 cutscore is distinctive. There was an evident trend for high Inattentive groups to have lower Planning scores relative to low Inattentive groups. This was also true for Attention, and to a lesser degree, for Simultaneous. With the exception of the low Inattentive group using the 60 cutscore, all Successive scores were clustered together.

These results indicate there is good support for the hypothesis that high externalizing (in this case Inattentive) scores are related to low scores in Planning and Attention. High Inattentive scores appear to be related to low Simultaneous and Successive scores as well.
<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>INA60</th>
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<th>INA70</th>
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<tbody>
<tr>
<td><strong>Between subjects</strong></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Inattentive</td>
<td>1</td>
<td>21.51**</td>
<td>2.96</td>
<td>7.34**</td>
</tr>
<tr>
<td>Error</td>
<td>180</td>
<td>(309.02)</td>
<td>(340.36)</td>
<td>(332.41)</td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>3</td>
<td>9.33**</td>
<td>14.60**</td>
<td>17.43**</td>
</tr>
<tr>
<td>PASS x Inattentive</td>
<td>3</td>
<td>.48</td>
<td>1.48</td>
<td>2.89*</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>1</td>
<td>.01</td>
<td>2.01</td>
<td>.13</td>
</tr>
<tr>
<td>Level 2 vs. Level 3</td>
<td>1</td>
<td>.86</td>
<td>.00</td>
<td>3.33</td>
</tr>
<tr>
<td>Level 3 vs. Level 4</td>
<td>1</td>
<td>.03</td>
<td>.85</td>
<td>.13</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(108.04)</td>
<td>(107.44)</td>
<td>(106.62)</td>
</tr>
</tbody>
</table>

Table 4.23: Analysis of Variance and Contrast Effects for CAS PASS and TRF Inattentive (INA60 = cutscore of 60; INA65 = cutscore of 65; INA70 = cutscore of 70). Values enclosed in parentheses represent mean square errors.
* p < .05. ** p < .01.
Question Seven. PASS profiles were compared using high and low TRF Aggressive groups for this question. Table 4.24 shows significant ($p < .01$) within-subjects effects for the PASS variable at all cutscores. Between-subjects effects and within-subjects contrasts were not significant, indicating profiles are parallel and coincident, and that the variable means are equal.
Figure 4.9 shows PASS Score profiles for low and high Aggressive groups. Mean Planning and Attention scores were tightly clustered, indicating the use of cutscores with this TRF Scale made little difference. Planning was slightly lower in the high Aggressive groups compared to the low groups, but there was no evidence of a trend. Successive scores rose from low to high Aggressive groups, suggesting a slight positive relationship may exist (the corrected correlation estimate between Successive and Aggressive was .12). In summary, these data offer little support for the study hypothesis that subjects with high externalizing (in this case, Aggressive) scores will have lower Planning scores.
Table 4.24: Analysis of Variance and Contrast Effects for CAS PASS and TRF Aggressive (AGG60 = cutscore of 60; AGG65 = cutscore of 65; AGG70 = cutscore of 70). Values enclosed in parentheses represent mean square errors.

** p < .01.
Question Eight. High and low TRF Internalizing Composite Scale groups were compared to PASS Score profiles for this question. Table 4.25 shows the within-subjects PASS variable effects were again significant ($p < .01$) at all cutscores. The between-subjects effect was also significant ($p < .05$) when the 60 and 70 cutscores were used, indicating the PASS profiles were not coincident when these cutscores were applied. However, within-subjects contrasts were not significant, which suggests the variable means were equal to the same constant at all cutscores.
### Table 4.25: Analysis of Variance and Contrast Effects for CAS PASS and TRF Internalizing Composite (INT60 = cutscore of 60; INT65 = cutscore of 65; INT70 = cutscore of 70). Values enclosed in parentheses represent mean square errors.

<table>
<thead>
<tr>
<th>Source</th>
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<tbody>
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<td><strong>Between subjects</strong></td>
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<td></td>
</tr>
<tr>
<td>Internalizing</td>
<td>1</td>
<td>4.68*</td>
<td>1.57</td>
<td>5.35*</td>
</tr>
<tr>
<td>Error</td>
<td>180</td>
<td>(337.18)</td>
<td>(342.97)</td>
<td>(335.97)</td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>3</td>
<td>17.02**</td>
<td>12.47**</td>
<td>6.38**</td>
</tr>
<tr>
<td>PASS x Internalizing</td>
<td>3</td>
<td>.41</td>
<td>.16</td>
<td>.15</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>1</td>
<td>.14</td>
<td>.40</td>
<td>.03</td>
</tr>
<tr>
<td>Level 2 vs. Level 3</td>
<td>1</td>
<td>1.28</td>
<td>.32</td>
<td>.28</td>
</tr>
<tr>
<td>Level 3 vs. Level 4</td>
<td>1</td>
<td>.50</td>
<td>.01</td>
<td>.09</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(108.08)</td>
<td>(108.23)</td>
<td>(108.24)</td>
</tr>
</tbody>
</table>
The high and low Internalizing groups had unequal covariance matrices when the 60 cutscore was used, Box’s $M = 18.95; F(10, 154211) = 1.85$, $p < .05$. However, since the groups sizes were roughly the same, $F$ values remain robust.

The significant between-subjects effect of the independent variable was clarified by one way ANOVA results. When using the 60 cutscore, the between-subjects effect of
CAS Attention was significant ($p < .05$). When using the 70 cutscore, the between-subjects effect of CAS Planning was significant ($p < .05$). These effects indicate the presence of a relationship between the TRF Internalizing Composite Scale and CAS Planning and Attention.

Figure 4.10 shows that most low and high Internalizing PASS profiles were clustered together. The PASS score profile for the high Internalizing group was distinctive when the 70 cutscore was used, but the sample size was small ($n = 16$). Five subjects within this high group were found to have a significant cognitive weakness (CW) in Planning, and four others had a significant CW in Successive.

Each mean PASS Scale score for the low Internalizing group was higher than its counterpart in the high group at all three cutscores, although some of the differences were small. Overall, there is some evidence to support the study hypothesis that subjects with high internalizing scores also have low Planning scores.

**Question Nine.** High and low TRF Externalizing Composite Scale groups were compared to PASS Score profiles for this question. Results are shown in Table 4.26. Once again, the within-subjects effect of the PASS variable was significant ($p < .01$) at all cutscores. The between-subjects effect was also significant at the 60 cutscore, indicating profiles were not coincident when that cutscore was used. One way ANOVA results include significant between-subjects effects of Planning ($p < .01$), Attention ($p < .01$), and Simultaneous ($p < .05$) when the 60 cutscore was used. Within-subjects contrasts, however, were not significant, indicating the variable means were equal to the same constant at all cutscores.
Parallelism of low Externalizing group PASS score profiles can be easily seen in Figure 4.11. Mean Planning and Attention scores were clustered closely together in the high Externalizing groups at all cutscores, but they were lower than mean Planning and Attention scores in the low Externalizing groups. Successive Scale scores rose with Externalizing scores, similar to the pattern seen on the Aggressive Scale, but there were no statistically significant relationships found between Successive and Externalizing scores. In summary, the data offer support for the study hypothesis that subjects with high externalizing scores also have low Planning and/or Attention scores on the CAS.
<table>
<thead>
<tr>
<th>Source</th>
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<th>EXT65</th>
<th>EXT70</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between subjects</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Externalizing</td>
<td>1</td>
<td>8.10**</td>
<td>.89</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>180</td>
<td>(331.05)</td>
<td>(344.25)</td>
<td>(345.94)</td>
</tr>
<tr>
<td><strong>Within subjects</strong></td>
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<td></td>
</tr>
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<td>PASS</td>
<td>3</td>
<td>14.01**</td>
<td>16.88**</td>
<td>17.17**</td>
</tr>
<tr>
<td>PASS x Externalizing</td>
<td>3</td>
<td>.55</td>
<td>1.59</td>
<td>2.10</td>
</tr>
<tr>
<td>Level 1 vs. Level 2</td>
<td>1</td>
<td>.01</td>
<td>.84</td>
<td>.01</td>
</tr>
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<td>Level 2 vs. Level 3</td>
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<td>.49</td>
<td>.62</td>
<td>1.14</td>
</tr>
<tr>
<td>Level 3 vs. Level 4</td>
<td>1</td>
<td>.17</td>
<td>.32</td>
<td>1.05</td>
</tr>
<tr>
<td>Error(PASS)</td>
<td>540</td>
<td>(108.00)</td>
<td>(107.38)</td>
<td>(107.08)</td>
</tr>
</tbody>
</table>

Table 4.26: Analysis of Variance and Contrast Effects for CAS PASS and TRF Externalizing Composite (EXT60 = cutscore of 60; EXT65 = cutscore of 65; EXT70 = cutscore of 70). Values enclosed in parentheses represent mean square errors. **p < .01.
Questions Ten Through Fourteen. The remaining research questions examine TRF Syndrome Scale profiles for select groups of subjects with cognitive weaknesses on the CAS. This technique was intended to test both of the study hypotheses. It was hypothesized that subjects with significant Planning and/or Attention cognitive weaknesses would have TRF profiles that differed from those of students with Simultaneous or Successive cognitive weaknesses, or no cognitive weakness.
From the total sample \((n = 182)\), 35 subjects were identified as having a significant cognitive weakness (CW) in Planning. This represents 19.2 percent of the total sample. Only five subjects (2.7 percent of the sample) with a CW in Attention were found. Three subjects (1.6 percent of the sample) had concurrent weaknesses in Planning and Attention. Simultaneous weaknesses were identified in 16 subjects (8.8 percent of the sample), and Successive weaknesses in 21 subjects (11.5 percent of the sample). The remaining 102 subjects (56 percent of the sample) had no significant cognitive weaknesses.

Because of the small number of subjects with a CW in Attention, this area was not included in the statistical analysis of TRF profiles. The three subjects with concurrent CW in Planning and Attention were also excluded. Mean PASS Scale scores by CW for the remaining subjects are provided for comparative purposes in Figure 4.12. The figure shows that subjects with a CW in Attention also had a low mean Planning score relative to Simultaneous and Successive, but subjects with a Planning CW did not have a low mean Attention score. Simultaneous and Successive CW profiles are similar to Planning, there is a weakness in only one area. The “No CW” profile is relatively flat.

**Multivariate Results and Profile Analysis.** Multivariate main and interaction effects were examined using a repeated measures MANOVA procedure with one within-subjects dependent variable (TRF) having six levels (Anxious, Social Withdrawal, Unpopular, Self-Destructive, Inattentive, and Aggressive), and one between-subjects independent variable with four levels (Planning CW, Simultaneous CW, Successive CW, and no CW). Results from MANOVA showed a significant main effect of the TRF.
variable, Wilks' $\Lambda = .64$; $F(5, 166) = 18.89$, $p < .001$. This indicates that the levels of the dependent variable (TRF) were significantly different. An examination of mean TRF Syndrome Scale $T$ scores for the entire sample showed the mean Anxious $T$ score to be lower than the other mean Syndrome Scale scores. Mean externalizing scale scores (Inattentive and Aggressive) were higher than the other mean scores. Mean Social
Withdrawal, Unpopular, and Self-Destructive scores were fairly consistent. These variations may account for some of the difference in the main effect.

The multivariate interaction effect (TRF x CW) was not significant, Wilks' \( \Lambda = .89; F(15, 458.65) = 1.29, p = .204. \) This indicates that the main effect of the TRF variable was not dependent on the CW group assignment.

Table 4.27 shows the univariate within-subjects main effect of TRF was significant (\( p < .01 \)), indicating the TRF profiles were not level. One way ANOVA between-subjects effects were significant for TRF Anxious (\( p < .01 \)) and Social Withdrawal (\( p < .05 \)). The univariate between subjects-effect of CW and within-subjects TRF by CW contrasts, however, were not significant. This indicates that the hypotheses for profile analysis (parallelism, coincidence of profiles, and equal variable means) are all tenable, indicating differences in the TRF profiles by CAS cognitive weakness were due to error or chance. The Attention CW group was excluded from this analysis, however, so the results obtained did not represent the full spectrum of CW profiles that was sought for this study.

The CW groups had unequal covariance matrices in this analysis, Box's \( M = 113.98; F(63, 10392) = 1.61, p < .01. \) Examination of group variance showed that the largest variance was associated with the smallest group (Simultaneous CW, \( n = 16 \)). This indicates that the actual alpha level was greater than the chosen level for significance in this analysis.

**Question Ten.** This question asked whether subjects with a CW in Planning have a consistent pattern in their TRF scores. The profile of mean TRF Syndrome Scale T
scores for subjects with a significant cognitive weakness in Planning on the CAS was examined and compared to TRF score profiles of other CW groups to answer this question. Post hoc multiple comparisons using the Scheffe test indicated mean TRF Syndrome Scale scores for subjects with a CW in Planning did not differ significantly from TRF scores of subjects with a CW in Simultaneous or Successive, or with no CW.

TRF profiles for all CW groups are graphed in Figure 4.13. The Planning CW group had the highest mean TRF Inattentive and Aggressive Scale scores relative to the other CW groups. The mean Anxious score was the lowest TRF score in the Planning CW profile. Social Withdrawal, Unpopular, and Self-Destructive scores were about the same. The profile suggests that subjects with a cognitive weakness in Planning tended to have higher scores on the externalizing scales of the TRF, relative both to the other Syndrome Scales in this profile, and to mean externalizing scale scores on other profiles. However, no statistically significant support for the hypothesis that subjects with a CW in Planning have a unique TRF profile was found. Again, though, the omission of the Attention CW group from multivariate and univariate tests affects the certainty of conclusions based upon statistical analyses.

**Question Eleven.** The pattern of TRF Syndrome Scale scores for subjects with a significant cognitive weakness in Attention on the CAS was examined to determine whether these subjects had a unique TRF profile. Statistical analysis was not completed for this group due to the low number of subjects with a CW in Attention (n = 5). The Attention CW profile shown in Figure 4.12, however, is distinct from the other profiles. Social Withdrawal and Inattentive scores were elevated, while Anxious and Aggressive
were comparatively low. Unpopular and Self-Destructive scores fell between these extremes. In comparison to the Planning CW group, the TRF profiles showed that subjects with a CW in Planning or Attention both had high mean TRF Inattentive scores, but that high TRF Aggressive scores were more clearly associated with the Planning CW group than with the Attention CW group. This is supportive of the hypothesis that subjects with externalizing behavior problems also had low planning.

<table>
<thead>
<tr>
<th>Source</th>
<th>Df</th>
<th>F</th>
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<tr>
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</tr>
<tr>
<td>Cognitive Weakness</td>
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</tr>
<tr>
<td>Error(within cells)</td>
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<td>(39.77)</td>
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<tr>
<td>Within subjects</td>
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<tr>
<td>TRF</td>
<td>5</td>
<td>19.26**</td>
</tr>
<tr>
<td>TRF x CW</td>
<td>15</td>
<td>1.62</td>
</tr>
<tr>
<td>Error(TRF)</td>
<td>850</td>
<td>(39.83)</td>
</tr>
</tbody>
</table>

Table 4.27: Analysis of Variance for TRF Syndrome Scales and Cognitive Weaknesses (CW). Values enclosed in parentheses represent mean square errors. ** p < .01.
Figure 4.13: Mean TRF T Scores by Cognitive Weakness (ANX = Anxious; S/W = Social Withdrawal; UNP = Unpopular; s/D = Self-Destructive; INA = Inattentive; AGG = Aggressive; PLN = Planning; ATT = Attention; SIM = Simultaneous; SUC = Successive; CW = Cognitive Weakness).

Question Twelve. The pattern of TRF Syndrome Scale scores for subjects with a significant CW in CAS Simultaneous was examined to answer this question. Post hoc Scheffe test results indicate mean TRF scores for subjects with a Simultaneous CW did
not differ significantly from scores of subjects with a CW in Planning, Successive, or no CW. The Simultaneous CW profile is shown in Figure 4.12. Anxious, Social Withdrawal, Unpopular, and Self-Destructive mean scores were generally equal. Inattentive and Aggressive scores were slightly higher. With the exception of the Anxious Scale, the Simultaneous CW profile paralleled the Planning CW profile, but the Simultaneous CW TRF profile scores were about a half standard deviation lower than Planning CW profile scores. This indicates that Simultaneous processing deficits may be related to problem behavior in a manner similar to Planning deficits, but to a lesser degree.

In summary, no statistically significant support for the uniqueness of the TRF profile for the Simultaneous CW group was found. Once again, though, the absence of the Attention CW group from analyses should be considered as a potential limiting factor.

Question Thirteen. The pattern of TRF Syndrome Scale scores for subjects with a significant CW in Successive on the CAS was examined to answer this question. Post hoc Scheffe test results showed the mean TRF Anxious Syndrome Scale score for subjects with a Successive CW was significantly (p < .05) different from the mean Anxious score of subjects with no CW. This suggests that the TRF profile for the Successive CW group was not parallel with the profile of the “No CW” group.

Figure 4.12 shows that most mean Anxious scores clustered closely together, but that the mean for the Successive CW group was higher. The Successive CW profile suggests that subjects with high scores on the Social Withdrawal and Inattentive Scales
of the TRF may have also scored poorly on CAS Successive tasks. In summary, there is some evidence that the TRF profile for the Successive CW group is unique.

**Question Fourteen.** The pattern of TRF Syndrome Scale scores for subjects with no significant cognitive weaknesses was examined to answer this question. Figure 4.12 shows the No CW profile was relatively parallel with the Planning and Simultaneous profiles, but mean scores were slightly higher than Simultaneous and slightly lower than Planning scores on five of the six Syndrome Scales. This suggests that referral status (i.e. being referred for a multifactored evaluation) may have had more to do with differences in problem behavior than a CW in CAS Simultaneous for this sample. The significant difference between TRF Anxious scores in the Successive CW and No CW groups indicates there is some evidence that the TRF profile for the No CW was distinct.

**Summary of Findings**

The analyses conducted for this study were designed to evaluate relationships between cognitive processing and behavior problems in students referred for special education multifactored evaluations. Demographic data revealed the sample was roughly half White and half Black, and about two thirds male. Approximately 70 percent of the sample were within the age range of eight to thirteen years old. Over 65 percent of the total sample was determined eligible for special education services in one of three programs, Emotional Disturbance, Specific Learning Disability, or Developmental Handicap.
Correlational, multivariate, and univariate analyses were conducted using cognitive ability standard scores from the CAS and behavior rating scale T scores from the TRF. The largest correlation between CAS and TRF scores was - .40. All multivariate main effects were statistically significant, but interactions were not.

Statistically significant relationships between TRF Anxious and CAS Simultaneous and Successive were found. TRF Social Withdrawal was found to be significantly related to CAS Attention. TRF Unpopular and Self-Destructive were both found to be associated with CAS Planning and Attention.

The TRF Inattentive was significantly related to all four CAS PASS Scales, but no statistically significant relationships between TRF Aggressive and PASS Scales were found. The TRF Internalizing Composite was significantly related to all four PASS processes, and the Externalizing Composite was related to CAS Planning, Attention, and Simultaneous.

These findings provide some support for the primary hypothesis tested in this study. Subjects with high externalizing problem behaviors, reflected by their TRF Inattentive Syndrome and Externalizing Composite Scale scores, also manifested cognitive processing problems in CAS Planning and Attention. However, a statistically significant relationship between CAS Planning and/or Attention and the TRF Aggressive Scale was not found.

The secondary hypothesis tested in this study was also supported by some of the analysis results. Subjects with high TRF Internalizing Composite scores also manifested cognitive processing problems in Planning. Significant relationships between TRF
internalizing scales and CAS Attention, Simultaneous, and Successive scales were also found. This suggests that internalizing behavior problems are potentially associated with a wide range of cognitive processing difficulties.
CHAPTER 5

DISCUSSION

Overview

This study examined the relationship between the cognitive processes of Planning, Attention, Simultaneous processing, and Successive processing (PASS) and the behavioral characteristics of children referred for special education eligibility assessment. The PASS processes were evaluated using the Cognitive Assessment System (CAS; Naglieri & Das, 1997a). Student behaviors were assessed using the Teacher’s Report Form (TRF; Achenbach, 1991).

Throughout much of the twentieth century, children with problem behavior were frequently characterized as having generalized deficits in cognitive ability, as measured by traditional intelligence tests (Bergman & Walker, 1995; Kauffman, Cullinan, & Epstein, 1987; Kinnison, 1988; Mastropieri, Jenkins, and Scruggs, 1985; Paget, 1982; Schonfeld, et al., 1988; Teeter & Smith, 1993; Ysseldyke et al., 1988). In recent decades, studies that examined specific cognitive processes from more theoretical perspectives have indicated that there is a connection between poor cognitive planning and externalizing problem behavior (Enns, 1998; Matson and Fischer, 1991; Moffitt and
Lynam, 1994; Naglieri and Das, 1997b). Some studies have also found a relationship between attention or inhibitory problems and externalizing behaviors (Enns, 1998; Hurt & Naglieri, 1992; Nigg, et al., 1999; Stephens, Clark, & Kaplan, 1990). At least one study has shown a link between low cognitive planning and high levels of internalizing problem behaviors as well (Dixon, 1994).

Few studies using the standardized version of the CAS have been completed to date, and none have examined the relationship between CAS PASS Scores and the TRF, which is one of the more widely recognized and used behavior rating scales on the market (Martin, et al., 1995). This study is the first to explore that relationship.

Relationship of Results to Hypotheses

Two hypotheses were tested in this study. First, it was hypothesized that subjects with high externalizing Syndrome Scale or Composite scores on the TRF would have low scores in either Planning and/or Attention on the CAS. Second, it was hypothesized that subjects with high internalizing scores on the TRF would have low scores in Planning. The relationship of the study results to each of these hypotheses is discussed in this section.

Hypothesis One. Comparing CAS PASS Scale scores to TRF Inattentive and Aggressive Syndrome Scale and Externalizing Composite Scale scores tested the first hypothesis. Moderate support for the hypothesis was found. Significant correlations between CAS Planning, Attention, and Simultaneous and TRF Inattentive were found.
CAS Planning and Attention were also significantly correlated with the TRF Externalizing Composite. When the sample was divided into high and low groups using the T score cutoff of 60, changes in CAS Planning and Attention scores as TRF scores rose were particularly distinct relative to the Inattentive and Externalizing Scales. Although relationships between PASS scores and the TRF Aggressive Scale were not statistically significant, Planning and Attention were clearly distinguishable relative to TRF Aggressive when subjects were profiled on the basis of cognitive weaknesses (low Planning was more closely related than Attention to high Aggressive scores).

The results indicate there is a distinct relationship between poor cognitive Planning and Attention, as measured by the CAS, and externalizing problem behaviors, as measured by the TRF Inattentive Syndrome and Externalizing Composite Scales, for subjects in this study. The absence of a significant relationship between CAS Planning and TRF Aggressive, however, supports the null of hypothesis one.

**Hypothesis Two.** The second hypothesis involved the relationships between the CAS PASS Scale scores and TRF Anxious and Social Withdrawn Syndrome Scale and Internalizing Composite Scale scores. Limited support for the hypothesis that CAS Planning would be associated with TRF internalizing problems was found. All CAS PASS Scales were significantly correlated with the TRF Internalizing Composite. The strongest relationships between TRF Anxious and CAS were with the Simultaneous and Successive Scales. TRF Social Withdrawal and CAS Attention were also significantly related.
CAS PASS Scale scores were compared to two other TRF Syndrome Scales, Unpopular and Self-Destructive, which have been described by the test authors as a mixture of externalizing and internalizing behaviors (Achenbach & Edelbrock, 1986). CAS Planning and Attention were found to be significantly associated with these scales. Directional changes in Planning and Attention scores were consistent: as TRF Unpopular and Self-Destructive T scores rose, Planning and Attention scores fell. The results indicate that the constructs measured by the TRF Unpopular and Self-Destructive Syndrome Scales are clearly associated with the cognitive processes of Planning and Attention.

**Relationship of Results to Previous Research**

The results of this study are consistent with PASS theory, and other findings that poor cognitive planning and/or attention are associated with externalizing behavior problems (e.g., Dixon, 1994; Enns, 1998; Grodzinsky & Diamond, 1992; Moffitt, 1993; Moffitt & Lynam, 1994; Naglieri & Das, 1997b). A pattern of CAS Planning and Attention score changes relative to TRF Inattentive and Externalizing scores was found; CAS scores fell as TRF scores rose. This study did not, however, provide strong support for the hypothesized relationship between disruptive behaviors and low planning: TRF Aggressive and CAS Planning were not found to be significantly associated.

The relationship between Planning and anxiety was less distinct in this study than that reported by Dixon (1994). Planning related to internalizing problems in general, as
measured by the TRF Internalizing Composite, but this composite was significantly associated with all four CAS PASS Scales. The TRF Anxious Scale was shown to be significantly associated with CAS Simultaneous and Successive Scales, and TRF Social Withdrawal was found to be associated with CAS Attention. Differences in findings between the present study and Dixon (1994) may stem from design issues; Dixon's sample did not include subjects receiving special education services for ED. In the present study, 18 percent of subjects were identified as eligible for ED services. Dixon, however, included a self-report instrument in her design to assess subject anxiety. There were no self-report data in the present study.

Some findings in the present study concur with earlier research showing an association between Simultaneous and Successive processes and problem behavior (e.g., Enns, 1998; Gutwirth, 1997; Saneda, 1993). CAS Simultaneous was found to be associated with TRF Anxious, Inattentive, and both Composite Scales. CAS Successive was found to be associated with TRF Anxious, Inattentive, and the Internalizing Composite.

There are notable differences between the present study and previous reports of Simultaneous and Successive relationships with problem behavior. Saneda's (1993) report of a relationship between Simultaneous processing and conduct disorder was based on the CAS Figure Memory and Simultaneous Verbal tasks. Figure Memory scores were not included in this study (Figure Memory is not part of the CAS Basic Battery), and the Simultaneous Verbal task is an earlier, less refined version of Verbal-Spatial Relations. Saneda also used an experimental version of the CAS, which did not provide standard
scores. Furthermore, Saneda classified experimental and control groups in his study using scores from the Conner's Teacher Rating Scale (Goyette, Conners, & Ulrich, 1978), an instrument which has been criticized for its small standardization sample size and lack of demographic representativity (Oehler-Stinnett, 1992), and which measures a much smaller selection of problem behaviors than the TRF (Achenbach, 1991).

Enns (1998) reported a relationship between delinquency and the Simultaneous Verbal-Spatial Relations subtest. Since this task has a verbal component, Enns hypothesized that there is a connection between his finding and the commonly reported relationship between deficits in verbal skills and problem behavior (Moffitt & Lynam, 1994). Since Simultaneous scores reported in the present study are a combination of Verbal-Spatial Relations and Nonverbal Matrices, any relationship between verbal skills (in the Verbal-Spatial Relations subtest) and problem behavior would be more diffuse.

Saneda (1993), Gutwirth (1997), and Enns (1998) all reported finding a relationship between low Successive scores and problem behavior. Enns' findings, however, included the CAS Sentence Questions subtest, which was not a part of this study, since it is not included in the CAS Basic Battery. Differences in study designs are also notable; Gutwirth and Saneda both compared experimental groups to normal control groups. Enns compared his clinical sample to the CAS standardization sample. There was no control group in the present study.
Application of Results

The cognitive abilities of children with behavioral problems have not been adequately explored (Al-Hilawani & Poteet, 1995; Daley, Nagle, & Onwuegbuzie, 1997), but decisions affecting the educational futures of such children are commonly made with little consideration given to cognitive issues (Martin, et al., 1995). Acknowledgement and understanding of the relationship between cognitive planning, attention, and problem behavior could impact the decision-making process, as well as instructional planning (Wasserman & Becker, 1999).

Theoretically-based classroom interventions and instruction have been developed and tested for Planning (Ashman & Conway, 1993; Cormier, Carlson, & Das, 1990; Kar, Dash, Das, & Carlson, 1992; Naglieri & Gottling, 1995, 1997; Naglieri & Johnson, 1998), Attention (Douglas, 1980; Kirby & Williams, 1991), and Simultaneous and Successive processing (Carlson & Das, 1997; Das, Mishra, & Pool, 1995; Martinussen, Kirby, & Das, 1998; Molina, Garrido, & Das, 1997). The focus of these interventions has been primarily on improving academic performance in classroom settings. Changing internalizing or externalizing behaviors through cognitive-based intervention has typically been viewed as more appropriate for clinical or counseling settings (Hughes & Kemenoff, 1992). However, an increased understanding of the cognitive processes underlying problem behavior can help teachers cope with and assist children manifesting behavioral difficulties in the classroom, by facilitating communication and understanding of the nature of the problem (Brown, 1985).
Individuals taking part in decision-making in special education placement and service can also benefit from a greater understanding of the cognitive processing of children with problem behavior (Whitten, D’Amato, & Chittooran, 1992). For example, a child manifesting behavior problems concurrent with low cognitive planning may have very different instructional needs than a child with behavior problems but no planning deficit. The child with a planning weakness may benefit from intervention to remediate the cognitive deficit. It has even been suggested that specific remediation of cognitive processing deficits may have the potential to reorganize neural pathways in some children (Rutter, 1983). When information about cognitive processes is available, intervention design can become much more specific. There is a tremendous need for further research in this area.

Commentary

Acceptance and use of new ideas in educational theory and practice have historically been slow (e.g., Mort and Cornell, 1941; Tyler, 1988). For decades, intelligence has been predominantly viewed as an aggregate construct; and cognitive measurement using instruments, which were originally designed with little or no theoretical basis, have dominated the field of psycho-educational assessment (Esters, et. al., 1997; Zachary, 1990). Major shifts in cognitive assessment practices, which have occurred in the past, were more the result of changes in law and popular opinion than of developments in cognitive theory (Kaufman, 2000). Recent surveys indicate that
traditional intelligence assessment instruments are still most commonly used in practice (Alfonso & Pratt, 1997; Stinnett, et al., 1994, Wilson & Reschly, 1996). University training programs for school psychologists also continue to have a predominant focus on traditional instruments and practices. (Alfonso, et al., 2000).

Practitioners tend to use assessment instruments and methods learned during their training, and may not become familiar with recent developments on their own (e.g., Stinnett, et al., Wilson & Reschly, 1996). Therefore, if significant change is to occur, it may need to begin in university training programs (Alfonso, et al., 2000). Kaufman (2000), however, suggests that this is unlikely to occur until a much stronger body of research demonstrating the superior treatment validity of recently developed instruments is assembled and disseminated.

Limitations of Results

As with all research in the social sciences, the findings in the present study have limitations, some imposed by sample characteristics, and some by research design. These limitations are discussed in this section.

The entire sample of subjects used in this study was distinguishable by variation in PASS Scale scores; the mean CAS Planning score was low relative to Attention, Simultaneous, and Successive for the entire sample. In general, low Planning (relative to the other PASS processes) is not typical of special population samples (e.g., Naglieri, 1997b, 1999). This implies that low Planning may influence decisions to refer children
for special education evaluation in the school district from which the sample was drawn. If this is true, generalization of results from the present study will be limited to those with low Planning scores. Further research, which includes a control sample of non-referred subjects carefully matched to the sample of special children, should be conducted.

Characteristics of the TRF were potential limiting factors in the present study. TRF T score distributions are truncated in range, have unequal variance, and have uneven intervals (Achenbach & Edelbrock, 1986). The assignment of a T score of 55 to all raw scores at or below the 69th percentile resulted in heavily skewed distributions; for example, over 50 percent of the sample had Anxious Scale T scores of 55, but less than nine percent of subjects had TRF Inattentive Scale T scores of 55. Although accommodations for these issues were implemented when possible (e.g., correcting correlations for restricted range), the analysis of TRF Syndrome Scale profiles by CAS cognitive weakness could still have been adversely affected.

Scoring TRF protocols using pre-1991 procedures was another potential limitation in the present study, since this often left major portions of the TRF results (i.e., pre-1991 Syndrome Scales that are not consistent across age and gender groups) out of the study. Approximately 70 percent of the subjects, for example, had T scores on the TRF Nervous-Overactive Syndrome Scale, which appears on profiles for children under age 12 years. Scores from the entire instrument could have been used if protocols had been scored using 1991 procedures. Again, this was unavoidable due to the archival nature of the data.
Some results may have been affected by the grouping procedures used. When cut scores were applied to the TRF Scale distributions, consideration to the potential effect of adjacent scores was not given. For example, the Social Withdrawal Scale distribution included 12 subjects with a T score of 69. When a cut score of 70 was applied to the sample, these 12 subjects were included in the Low Social Withdrawal group, even though their T scores were little different from the nine subjects with a Social Withdrawal T score of 70, who were in the High Social Withdrawal group. This situation was also true of the Unpopular Scale (which included 15 subjects with an Unpopular T score of 64), the Self-Destructive Scale (14 subjects had a T score of 69), the Inattentive Scale (12 subjects had a T score of 69), and the Internalizing Composite Scale (13 subjects had a T score of 64). This clustering of scores at or near the cut scores potentially affected both analysis results and group size.

Directions for Future Research

The present study adds to the fund of knowledge about relationships between cognitive processes and problem behavior, but additional research is still greatly needed. Existing hypotheses, such as the relationship between CAS Planning and externalizing or internalizing problem behavior, should be studied further. New hypotheses need to be formulated. For example, relationships between CAS Simultaneous and Successive and
problem behavior remain unclear. The relationship between CAS Attention and problem behavior may be more substantial than previous studies have shown. These topics merit investigation.

Design considerations for sample characteristics and choice of instruments were not primary issues in this study, because the data were archival. Controlling for and/or studying variables such as age, gender, or socio-economic status could be done if original data collection were part of the research design. Future studies, which include control samples of non-referred subjects, would be ideal.

Studies using the 12-subtest Standard Battery of the CAS would be appropriate where researchers will be collecting original data. Likewise, use of a behavior rating scale with a full (instead of truncated) range of normally distributed scores, such as the Devereux Scales of Mental Disorders (Naglieri, LeBuffe, & Pfeiffer, 1994) or the Behavior Assessment System for Children (Reynolds & Kamphaus, 1992) would be appropriate. A battery of tests including observations, ratings, and self-reports of behavior would be desirable.

The achievement and demographic data in the present study were de-emphasized for the sake of simplicity. Other studies have shown that children with problem behavior also typically have concurrent deficits in academic achievement (Center, 1993; Mastropieri, Jenkins, & Scruggs, 1985). Naglieri (1999b) shows that CAS cognitive weaknesses are also significantly related to low scores on academic achievement tests. These relationships need to be further explored.
Data could be examined differently for this or similar samples of students, if subject grouping by distinct or commonly accepted categories were made an intentional part of the design. For example, examination of CAS and behavior relationships by special education program could easily be accomplished with the present data, although it has been noted elsewhere in this document that this form of categorizing has serious limitations (e.g., Center, 1993; Clarizio & Higgins, 1989; Costello, 1993).

Finally, there is a tremendous need for intervention research. Seminal studies of the treatment validity of academic interventions based upon PASS theory are promising (Naglieri, 1999a), but the study of cognitive interventions for behavior problems in the classroom is in its infancy. Since it has been suggested (e.g., Kaufman, 2000) that the lack of research showing treatment validity is a primary reason practitioners may resist change, this area may have immense potential to influence educational decision-making and service provision.

Conclusion

In summary, moderate support was found in the present study for the hypothesis that subjects with high externalizing problems have low cognitive planning and attention. Some support was found for the hypothesis that subjects with high internalizing problems have low cognitive planning. Relationships between simultaneous and successive cognitive processes and problem behavior were also found. Limitations of the findings and suggestions for future research were made.
Findings in the present study are consistent with PASS theory and much of the previous related research. It has been suggested that results have implications for instruction and classroom practice that could potentially impact school staff and students at all levels.
APPENDIX

NOTES ON STATISTICAL ANALYSES

Correction of correlations with restricted range using the formula from Cohen and Cohen (1983) were completed using Microsoft Excel®. An example of the transformation formula used is shown below. “C4” refers to a spreadsheet cell with an uncorrected correlation value. This example was a transformation of a CAS standard score, and shows the population standard deviation of 15, and the sample standard deviation of 12.7.

\[ (C4 \times \frac{15}{12.7}) \div \sqrt{(1 + (C4^2) \times (\frac{15}{12.7})^2 - 1))} \]
Statistical analyses were completed with SPSS 9.0. An example of the SPSS syntax for profile analysis is shown below.

GLM
pln att sim suc BY anx60
/WSFACTOR = pass 4 Repeated
/WSDESIGN = pass
/DESIGN = anx60.

The General Linear Model (GLM) procedure was used for this analysis. GLM provides both multivariate and univariate results. In the example, the within-subjects factor “pass” has four levels: “pln” (Planning), “att” (Attention), “sim” (Simultaneous), and “suc” (Successive). The independent variable in the example is “anx60” (the TRF Anxious Scale transformed to a biserial distribution using the cutscore 60).

The “Repeated” term shows how dependent variable contrasts were completed. It is the appropriate approach for profile analysis, which requires a non-orthonormalized transformation of the dependent variable. The repeated contrast method compares adjacent categories. Each level of the dependent variable except the first was compared to the level that preceded it in this analysis. So, for example, Attention was compared to Planning, Simultaneous to Attention, and Successive to Simultaneous.

For comparative and informative purposes, an example of SPSS syntax for profile analysis using the MANOVA procedure is shown below. In this example, analysis of the
transformed levels of the dependent variable are better illustrated than in the GLM syntax. Both of these procedures provide the statistics required to test the three hypotheses of profile analysis.

**MANOVA**

```
pln att sim suc BY anx60 (0,1)
/TRANSFORM= REPEATED
/RENAME= AVERAGE, AMINUSB, BMINUSC, CMINUSD
/ANALYSIS=(AMINUSB, BMINUSC, CMINUSD/ AVERAGE).
```
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