7-1989

Construct validity and development of local norms in the assessment of ADHD.

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CONSTRUCT VALIDITY AND DEVELOPMENT OF LOCAL NORMS IN THE ASSESSMENT OF ADHD

A Thesis

Presented to the

Department of Psychology

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Specialist in Education

University of Nebraska at Omaha

by

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July, 1989

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THESIS ACCEPTANCE

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ACKNOWLEDGEMENTS

I would like to thank the Psychology staff at Hampton City Schools, Hampton, Virginia, most especially Dr. Dwaine R. Harrell, for the assistance and support they have given me in carrying this project to completion.

Appreciation is extended to Dr. Richard Wikoff, Dr. Norman Hamm and Dr. James Akers for serving on my thesis committee, and for the patience they have shown me in the past year.

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ABSTRACT

A pilot study was performed to determine the validity of on-task behavior and locally developed attention tasks, to assist in the identification of children with ADHD. Subjects were third grade students in the Hampton City Public Schools. Means and standard deviations were computed for time-on-task as well as number correct and number committed for each of five separate attention tasks. A correlation analysis was performed to compare results of attention tasks with each other as well as with the Abbreviated Conners Teacher's Scale (ACTS), a Hyperactivity Index, and IQ. Results were in the expected direction, although correlations with ACTS were lower than anticipated. A discussion of the results and suggestions for future studies are given.

CHAPTER I

Introduction

Statement of the Problem

Fidgety Phil

He won't sit still

He wiggles

He giggles

The naughty restless child

Grows still more rude and wild

(An 1845 rhyme by H. Hoffman as cited in Steward, 1970)

The possible situational-specific nature of the symptoms of Attention-deficit Hyperactivity Disorder (ADHD) calls for an inter-disciplinary approach to the assessment and diagnosis of this disorder in children. Since ADHD children often display difficulty in academic settings, it is not unusual for the teacher to be the primary referral source (Brown, 1985). The referral is frequently made to the child study team in the child's school. If the team suspects, after hearing input from teachers and/or parents, that the presenting problem may be ADHD, the parents are generally encouraged to take the child for a medical evaluation to verify or discount the presence of this disorder. The medical assessment is necessary, since if the child is determined to have ADHD, the usual initial therapy is drug treatment, which only a medical doctor could

prescribe (Copeland, Wolraich, Lingren, Milich & Woolsen, 1987; and Wender, 1987). However, physicians' need for input from multiple sources has been well documented in the literature (Copeland, et al). Since studies have shown that parents may not always be the best informants regarding ADHD symptoms (Sleater, 1982) and clinical observation of behavior may be unreliable, (Sleator & Ullman, 1981), school personnel could, and the author feels should, play an instrumental role in the data gathering process. This is particularly true since research suggests that teacher ratings of behavior tend to be more reliable and more sensitive to hyperactive behavior than parent ratings (Barkley, 1981). "Teachers may be a better source of rating attentional behaviors in the 'real world' than parents simply because they have a number of children who are doing the same tasks, a built-in control group, in addition to the fact that the classroom setting may put more stress on the attentional mechanism" (Cantwell, 1986).

In addition to teacher rating scales, classroom observations of on/off task behavior, as well as objective assessment methods of attention, vigilance, and impulsivity (generally variations of the Continuous Performance Task developed by Rosvald, Mirsky, Sarasen, Bransome & Beck, 1956) have been suggested for use to assist in the diagnosis of ADHD (Barkley, 1981). While it may be ideal for the physician to make school visits and observations of the

client in his natural setting, this option is often not practical in terms of time and cost factors.

The staff of the Psychological Services department in Hampton City Schools, Hampton, Virginia, is attempting to address this need by developing cost-effective measures and local norms to assist the primary care physician in the diagnosis of Attention-deficit Hyperactivity Disorder.

Literature Review

Historical Perspective

The syndrome currently known as Attention-deficit Hyperactivity Disorder (ADHD) was first described in children who had suffered injuries to the brain (Wender, 1987). As a result, terms such as Brain Damage Syndrome and Minimal Brain Damaged were used to label children with hyperactive symptoms in the early part of this century (Martin, Welsh, McKay & Bareuther, 1984).

In the 1960's the term minimal brain dysfunction was recommended by child neurologists who argued that brain damage should not be inferred from behavioral signs alone. This new term was used to describe children with learning disabilities, hyperactivity, distractibility, and emotional problems (Clements, 1966). Emphasis began to shift to focus on motor activity levels, and names such as the Hyperactive Child Syndrome (Stewart, Pitts, Craig & Dieruf, 1966), and the Hyperkinetic Child Syndrome (Cantwell, 1977), appeared on the scene. The DSM-II (American Psychiatric

Association, 1968) label of Hyperkinetic Reaction of Childhood tended to emphasis the inability of certain children "to restrict their activity level in an age-appropriate fashion as a situation demands" (Barkley, 1982).

Later, a belief that an attention deficit was the core symptom in the disorder led to another change in terminology (Douglas & Peters, 1979). The American Psychiatric Association, in its 1980 DSM-III, changed the label to Attention Deficit Disorder, and offered the first diagnostic system of psychiatric disorders of childhood which specified criteria for the diagnosis of each disorder. In the DSM-III criteria, three subtypes were postulated: Attention Deficit Disorder with Hyperactivity; Attention Deficit Disorder Without Hyperactivity; and Attention Deficit Disorder, Residual Type. In the subtype with hyperactivity, specific symptoms in three areas were required:

A. Inattentive--At least three of the following:
   1. often fails to finish things he or she starts
   2. often doesn't seem to listen
   3. easily distracted
   4. has difficulty concentrating on schoolwork or other tasks requiring sustained attention
   5. has difficulty sticking to a play activity

B. Impulsivity--At least three of the following:
   1. often acts before thinking
   2. shifts excessively from one activity to another
   3. has difficulty organizing work (this not being due to cognitive impairment)
   4. needs a lot of supervision
   5. frequently calls out in class
   6. has difficulty awaiting turn in games or group situations

C. Hyperactivity--At least two of the following:
   1. runs about or climbs on things excessively
   2. has difficulty sitting still or fidgets excessively
   3. has difficulty staying seated
   4. moves about excessively during sleep
   5. is always "on the go" or acts as if "driven by a motor"

(American Psychiatric Association, 1980)

The diagnosis of the subtype without hyperactivity was the same as above except that the person never had signs of hyperactivity. The residual subtype required attentional and impulsivity problems and a past history of hyperactivity. All three subtypes required onset before the age of seven, duration of at least six months and an exclusionary clause stating that the diagnosis not be made if symptoms were due to Schizophrenia, Affective Disorder, or Severe or Profound Mental Retardation.

Around this time, cognitive psychologists became more interested in studying the problem of attention and it was hypothesized that attention could be subdivided into several different elements which include: the capacity to focus upon or select some part of the environment; to persist (sustained attention) and to be able to shift adaptively from one aspect or element to another (Zubin, 1975).

In 1987, the DSM-III was revised and the disorder was again given a new name with diagnostic criteria changing as well (American Psychiatric Association, 1987). A field trial was used to determine the sensitivity and specificity of a number of symptoms from the best distinguishing the ADD

syndrome from conduct disorder and oppositional disorder (Cantwell, 1986). The DSM-III-R's criteria require a disturbance of at least six months during which at least eight of the following 15 behavioral symptoms are present:

(1) often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness)
(2) has difficulty remaining seated when required to do so
(3) is easily distracted by extraneous stimuli
(4) has difficulty awaiting turn in games or group situations
(5) often blurts out answers to questions before they have been completed
(6) has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), e.g. often fails to finish chores
(7) has difficulty sustaining attention in tasks or play activities
(8) often shifts from one uncompleted activity to another
(9) has difficulty playing quietly
(10) often talks excessively
(11) often interrupts or intrudes on others, e.g. butts into other children's games
(12) often does not seem to listen to what is being said to him or her
(13) often loses things necessary for tasks or activities at school or at home, e.g. toys
(14) often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking), e.g. runs into street without looking

(American Psychological Association, 1987)

A criteria is considered met only if the behavior is considerably more frequent than that of most people of the same mental age, and the age of onset is prior to seven. An exclusionary clause is included that states that when the symptoms are present, the diagnosis is not made if the child

also meets the criteria for a Pervasive Developmental Disorder.

The DSM-III-R also states that semi-impairment in social and school functioning is common and school failure is the major complication. This disorder is believed to occur in approximately 3% of children, and the sex ratio is six to nine times more common in males.

Current Assessment Techniques

The Mental Health Committee of the Canadian Paedeatric Society (1988) suggests that the optimal evaluation of a child suspected of having ADHD should be done by a community-based team composed of a physician, a teacher, a psychologist, a social worker, and other education or health care professionals.

Barkley (1981) agrees, stating, "It therefore appears that no single profession can meet all the needs of hyperactive children and their families. Multidisciplinary cooperation in evaluation and treatment is imperative if even partially adequate services are to be given." He goes on to say that each profession needs to respect its individual competencies and limitations and should involve other professionals as the need arises. The evaluation should be conducted by the professional who can take the time necessary to coordinate effective assessment, treatment, and follow up care for the hyperactive child and the family.

Interviews. The assessment generally begins with a clinical interview, not only with the parents, but the child as well. While direct observation of the child is important, the diagnosis of ADHD should not be ruled out by the absence of symptoms during a clinical visit, as children with ADHD do much better in structured, one-to-one environment (Meller & Lyle, 1987).

Several standardized interview formats for use with parents and/or children are available. The formats are generally lists of symptoms to be presented along with some systematic guidelines for querying an informant and recording their responses. Some interview formats with items relating to ADHD problems include: the Diagnostic Interview for Children and Adolescents (DICA--Herjanic, Brown, & Wheatt, 1975); the Diagnostic Interview Schedule for Children (DISC--Costello, Edelbrock, Kalas, Kessler & Klaric, 1982); the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS--Puig-Antich & Chambers, 1978); the Interview Schedule for Children (ISC--Kovacs, 1978); and the Children's Assessment Schedule (CAS--Hodges, McKnew, Cytryn, Stern & Kline, 1982). Barkley, 1987, cautions that these formats, while having some face validity, require more study of their construct, concurrent and predictive validity.

If parents supply affirmative responses to specific symptoms, they are frequently asked for recent examples,

frequency of symptom occurrence, the severity of each symptom and the context of its occurrence. The interviewer also needs to find out what methods parents have tried in dealing with a particular symptom as well as if any certain factors seem to make the symptoms better (Cantwell, 1986).

In addition to pinpointing specific symptoms, parents generally are asked demographic information, child's health and medical history, developmental history, school and academic information, and information concerning the child's social interaction with peers. Historical health and medical details about the parents and their families are useful, as is information concerning any existing marital problems (Barkley, 1981).

Rating Scales. The use of rating scales is beneficial in that they serve as a means of quantifying behavior in a variety of different settings (Cantwell & Baker, 1987). There are limitations in the use of rating scales, (e.g. they basically are just rater's opinions, therefore they are subject to rater bias, halo effects, subjectivity, level of literacy needed to complete, etc.), however, they are advantageous if used in combination with other sources of information and instruments (Barkley, 1987).

Some current behavior rating scales available include: Conners Teacher Rating Scale (Conners, 1986); Conners Parent Rating Scale (Conners, 1985); the Child Behavior Checklist--

Parent Edition (Ackenbock & Edelbrock, 1983); the Child Behavior Checklist--Teacher Edition (Ackenbock, et al, 1987); The Yale Children's Inventory (Schaywitz, Schnell & Shaywitz, 1979); and the ADDH Comprehensive Teacher Rating Scale (ACTeRS--Ulleman, Sleator & Sprague, 1985). According to Barkley (1987) the Conners' scales are the most widely used rating scales although the others have been found to be useful as well.

The Conners Parent Rating Scale (CPRA) comes in three different scales: a 96-item scale; a revised 48-item scale, and an abbreviated 10-item scale. The revised form yields five factor scales: Conduct Problems, Learning Problems, Psychosomatic, Impulsive-Hyperactive and Anxiety. The abbreviated scale appears to confound ADHD with aggressive and oppositional behaviors and some researchers have recommended it not be used for ADHD studies (Ullemun, Sleator & Sprague, 1985).

Three versions of the Conners Teacher Rating Scale are available. They consist of the 39-item original version, the 28-item revised version and the 10-item abbreviated version. The revised version yields three factors: Conduct Problem; Hyperactivity; and Inattentive-Passive.

The Child Behavior Checklist (CBCL)--Parent Edition, consists of 20 items making up a Social Competence Scale and 113 items on the Behavior Problems Scale. The CBCL has been shown to discriminate ADHD from normal and other psychiatric

groups of children (Mash & Johnston, 1983).

The CBCL--Teacher Edition has two scales: Adaptive Functioning and Behavioral Problems. On the Adaptive scale, six scores are derived: School Performance, Working Hard, Behaving Appropriately, Learning, Happy and a Summary score. While the factors on the Behavior Problems scale are somewhat different for different ages and sexes, factors for boys ages 6-10 are given here as they were deemed most appropriate for assessment of ADHD: Anxious; Social Withdrawn; Unpopular; Self-Destructive; Obsessive-Compulsive; Inattentive; Nervous; Overactive and Aggressive.

The Yale Children's Inventory (YCI)--for parents--consists of 62 items which are divided into two broad-band scale groupings: a Behavioral grouping and a Cognitive grouping. The Behavioral grouping consists of narrow band scales of: Hyperactivity; Impulsivity; Tractability; Conduct Disorder-Socialized; Conduct Disorder-Aggressive and Negative Affect. The conduct grouping contains the scales of Academics, Language and Fine Motor.

The ADDH Comprehensive Teacher Rating Scale (ACTeRS) provides ratings of children in the following areas: Attention, Hyperactivity, Social Problems, and Oppositional Behavior. The teacher uses a five-point scale for rating each item, and is typically required to rate a specific child several times per day.

Objective Tests. When the view was prevalent that

hyperactivity was the main symptom in this disorder (prior to DSM-III), numerous measures of activity level were developed for research with hyperactive children. These included "actometers", which were modified self-winding wrist watches that were attached to wrists or ankles to measure activity. The measurement of motion in arms, legs, or trunks was done using "pedometers" that were attached to arms, legs, or children's belts. Pneumatic pads were sometimes used to count footsteps and motion-sensitive seats were developed to assess "seat restlessness" (Ross & Ross, 1976).

Barkley, (1981) discusses some limitations of the aforementioned measures. He states that the quantitative scores generated when raters were used, showed poor reliability over time, across settings and between judges. Also, the meaning of the scores obtained was doubtful due to the lack of normative data, and the activities measured were highly influenced by situational factors without any idea as to what these important factors might be. These measures gave no information with respect to the antecedents, or consequating events. Lastly, research has shown that these measures do not correlate well with parent rating scales, "thus it appears that they do not measure the same behavior that is of most concern to parents."

Some assessment instruments developed to objectively assess sustained attention and vigilance include: The

Continuous Performance Test (CPT--Rosvold, Mirsky, Sarasen, Bransome & Beck, 1956); the Trail Making Test, part of the Halstead-Reitan Neuropsychological Battery, (Reitan & Torshes, 1959); the Talland Letter Cancellation Test (Talland, 1965); the Stroop Test (Stroop, 1935); the Wisconsin Card Sorting Test (WCST--Grant & Berg, 1948); and the Gordon Diagnostic System (Gordon, 1982).

The CPT is a visual vigilance task where subjects are required to press a response key for certain target letters and to withhold responses to nontarget letters for periods of 10 minutes at a time. An X is the target letter in the "X" task; and X following A in the "AX" task. The scores derived are the mean number of correct responses, the mean number of errors of commission, as well as the total reaction time for correct responses.

The Trail Making Test requires the subject to make a pencil line connecting a series of numbers in order, and then, in a similar task, to alternate numbers and letters. The score derived from this task is the time needed to complete the task.

The Talland Letter Cancellation Test, requires the subject to cross out designated letters on a sheet of random letters. The score derived here is the mean number correct.

The Stroop Test requires the subjects to read a series of color names (red, green, blue) printed in inks of contrasting colors. The score derived is the mean number of

words read correctly.

The WCST requires the subject to sort a set of test cards according to a set of sample cards. The test cards have different colors, forms or numbers which do not correspond with the sample cards. The subject must determine which category defines the match. The score derived is the number of errors.

The Gordon Diagnostic System is a microprocessor-based portable unit which includes a Delayed Response Task and a Vigilance Task. On the Delayed Response Task the subject is required to inhibit responding in order to earn points. The subject is told to press a button, wait a while, and press the button again. If she/he is able to refrain for six seconds or longer, a light flashes and a reward counter increases. If the response time is shorter than 6 seconds, the timer resets and no reward points are recorded. The scores derived from this task are: the number of responses; the number of correct responses and the Efficiency Ratio (percentage of correct responses). The Vigilance Task requires that the subject inhibit responding under conditions that make demands for sustained attention. The subject is to press a button every time a "1" is followed by a "9". Younger children use the "1" mode which requires the subject to press the button every time a "1" appears. Scores derived on this task are number of omissions and number of commissions.

In addition to the aforementioned, specific subtests on the Wechsler Intelligence Scale for Children-Revised (WISC-R), have been shown through factor analysis to be sensitive to attention, concentration and distractibility (Kaufman, 1979). These subtests are: Arithmetic (mentally solving a verbally presented mathematical problem); Digit Span (the ability to hold numbers in short-term memory, and to either repeat them immediately or to repeat them in reverse order); and Coding (writing symbols below a series of digits using a digit-symbol code).

Methods developed to measure impulse control are: the Matching Familiar Figures Test (MFFT--Kagan, 1966), and the Delayed Response Task of the Gordon Diagnostic System which was described on the previous page.

The MFFT requires the subject to choose from an array of six very similar pictures, the one which precisely resembles the sample picture. The score derived is the mean time taken to the first response (latency) and the total number of incorrectly identified pictures. Recent research, however, has found the scores heavily confounded by intelligence (Milich & Kramer, 1984).

Observation-Coding Systems. Several behavior coding systems are available as tools used for collecting observational data. One is the Response Class Matrix (Mash, Terdal & Anderson, 1973), which measures parent-child interactions. Two coders are needed, one who scores the

parent behavior and the child's responses to him/her, while the other focuses on the child's behavior and the parent's response to him/her. Parent behavior is recorded in seven well-defined categories (command, command-question, question, praise, negative, interaction and no response) and the child's responses in six categories (compliance, independent play, question, negative, interaction and no response). Scoring categories for the child antecedent-parent response matrix uses the same categories except the coder uses a seventh child behavior category for "competing" or noncompliant behavior (Cunningham & Barkley, 1979).

Patterson, Ray, Shaw and Cobb (1976), developed a code consisting of 29 behavioral categories that capture antecedent-response-consequence sequences in social interactions between a child and others.

The Stony Brook System (Abikoff, Gittelman-Klein & Klein, 1980) uses a 15-second-interval recording procedure and 14 behavioral categories. Only the initial occurrence of each type of behavior during each 15-second interval is recorded, with the exception that off-task behavior, noncompliance, out-of-seat behavior verbalization, and daydreaming are scored only if they occur for more than 15 consecutive seconds. The nontimed categories are interference; solicitation; minor motor movement; gross motor movement--standing; gross motor movement--vigorous; physical aggression; threat or verbal aggression to

children; threat or verbal aggression to teacher; and absence of behavior.

Other observational systems used in the classroom often employ time sampling or interval recording procedures for hyperactive behaviors such as "out of seat", disruption, off-task, aggression, noncompliance, and vocalizing.

Neuropsychological Tests. Recent research in neuropsychology has attempted to relate attention deficits to some kind of central nervous system localization scheme. Psychophysiological assays using cognitive event-related potentials (ERP's) have suggested that attention is a complex behavior consisting of a number of elements or components, each of which may be, in part, dependent upon a different region of the central nervous system. ERP's are transient voltage fluctuations generated in the brain in conjunction with different sensory, motor or cognitive events. Studying EEG patterns on subjects as they perform some of the attention tasks previously described holds promise as a future direction in ADHD assessment (Mirsky, 1987).

Purpose of the Study

The main goal of this study was to determine the validity of locally developed measures of attention with the Abbreviated Conners Teacher Scale (ACTS). Since the construct of attention has been shown to involve a number of different elements or aspects, an ADHD child may have

difficulty in varying degrees with the different components that make up attention (vigilance, being able to shift attention, and control impulses). Since cost-effective measures that could be group administered could not be found, the staff at Psychological Services at Hampton City Schools developed their own measures.

The Abbreviated Conners Teacher Scale (ACTS) was used as the standardized measure to check validity. This measure was selected because it was believed to be the most unintrusive measure as far as the cooperating teachers' time and effort was concerned. This was especially felt necessary as the study was done in the last month of the school year when teachers frequently are burdened by the end-of-the-year tasks.

Another goal of this project was to serve as a pilot study to determine the feasibility and usefulness of developing local school norms for comparison of on-task behavior, attention, vigilance, ability to shift attention, and impulsivity to assist in identifying children with Attention-deficit Hyperactivity Disorder in the Hampton City Schools.

Since school personnel are frequently asked to assist in the identification and assessment of potential ADHD children, it is believed that local norms would be beneficial to determine if a child's behavior in the aforementioned areas differs significantly from others in

his class. This goes along with the diagnostic criteria of ADHD in the DSM-III-R, which requires developmentally inappropriate degrees of "inattention, impulsiveness, and hyperactivity" be present.

The decision to use the third grade classes for the pilot study was made in part because third grade is the midpoint of the target classes (grades 1-5) that will be normed if this study suggests that would be appropriate. Part of the decision was also based on the availability and the cooperation of teachers.

CHAPTER II

Method

Subjects

Subjects for the validity study were students in seven third grade classes (approximately 25 students per class) in elementary schools that were believed to be representative of the third grade school population based on socioeconomic level and race. The sample number represented over 10% of the total number of students enrolled in third grade classes in Hampton City Schools.

In addition, two hundred third grade students served as subjects for developing on-task, off-task norms. A stratified random sample was observed such that 25% of the sample consisted of white males, 25% black males, 25% white females and 25% black females. This distribution approximately represents the school population in the Hampton City Schools.

Materials

Materials for the validity study were developed locally by the Personnel in the Psychology Department of Hampton City Schools. The materials used consisted of a booklet with five pages, one page for each of five tasks (see Appendix A-D). The first, third, and fifth tasks required use of a page of random numbers (see Appendix A). The second task utilized a page with numbered rows of random letters (see Appendix B), and a tape with random letters

spoken at the rate of one every four seconds. The fourth task consisted of a page with rows of randomly placed computer pictures of common objects, and a laminated page of the same object in a slightly different order. (See Appendix C and D).

The above measures were correlated with the Abbreviated Conners Teachers Scale (Conners, 1986).

Observation data sheets were used for the norming part (see Appendix E), for the coding of on task/off task behavior of individual students.

Procedure

Data for the attention tasks and teacher ratings were collected simultaneously. The five tasks were administered to an entire class in one session through group administration. The directions for each task were explained thoroughly, examples demonstrated on the board, and any questions answered prior to the beginning of each task. On the first task, pairs, the students were required to put a line through every set of two of the same numbers that were next to each other in any row. They were allowed five minutes to complete the task. Crayons were used to mark so no erasures could be made. This was done to allow for impulsive tendencies to be detected (e.g. beginning to mark sets of three, etc.). The second task, audio/visual, required the student to listen to a tape with random numbers presented every four seconds. As they listened to the tape,

they were to follow along in their booklets and mark off any letters seen on the page that did not match the letter heard. The third task, 2-8, required the student to mark all the "8s" that were preceded by a "2". Three minutes was allowed for this task. On the fourth task, pictures, students were to compare the laminated page of pictures with the page of pictures in their booklet and to mark the picture(s) in their booklet that did not match the picture on the laminated page. Five minutes was allowed for this task. On the fifth task, 3/kind, students were required to mark all of the sets of three of the same numbers that followed each other in a row. Three minutes was allowed for this task.

Each of the five tasks yielded two scores: the number correctly marked, and the number committed (those marked that should not have been). It was believed that the number correct were indicators of attention and vigilance. The number committed represented impulsive tendencies. The picture task also gave an idea of a child's ability to switch attention from one sheet to the other and back. The audio/visual task required the child to attend auditorily as well as visually.

As these tasks were administered in the classrooms, the teacher was asked to complete the Abbreviated Conners Teachers' Scale on each student. An assistant who was unaware of the purpose of the study, obtained the ability

score ratings on each student from his/her Iowa Test of Basic Skills. She coded the student's measures in such a way that she was the only one that knew which student went with each code. In this manner we were able to control for ability, and also compare each student's teacher rating with his/her scores on the attention measures.

The on task/off task observations were obtained in the following manner: The behavior technician would enter a classroom, be assisted by the teacher in the random selection of two students, complete the observation by observing for 20 seconds, recording for 10 seconds, and so on, until each student was observed for a total of 30 minutes. These observations took place at varied times throughout the day, with a greater emphasis on observations during morning classes.

CHAPTER III

Results

A correlation analysis was carried out in order to measure the strength of relationships between tasks and of each task with IQ and teacher ratings. Results of this analysis appear in Table 1. As can be noted, a negative statistically significant relationship exists between ACTS and number correct on the pairs task, the aud/vis task, the three/kind task, and with IQ. Other significant relationships are seen between ACTS and the numbers committed on the aud/vis and 3/kind tasks. Positive significant correlations were found between IQ and numbers correct on the pictures and 3/kind tasks, while negative relationships appear between IQ and number committed on aud/vis and pictures tasks. The table shows numerous significant relationships between tasks, some of the highest include: a negative relationship between number correct aud/vis and number committed aud/vis; between number committed on the 2-8 task and number correct aud/vis (-) and number committed aud/vis (+); number correct pairs with number correct 2-8 task (+) and number correct 3/kind (+); number committed pairs with number correct aud/vis (-) and number committed aud/vis (+), number committed 3/kind with number correct aud/vis (-) and number committed aud/vis (+); number correct 2-8 and number correct 3/kind (+); number

Table 4

Correlations between Attention Tasks, ACTS and IQ

	Pairs A	Pairs C	Aud/Vis A	Aud/Vis C	2 - 8 A	2 - 8 C	Pict A	Pict C	3/Kind A	3/Kind C	ACTS	IQ
Pairs A	** 1	.147	.132	*-.187	** .555	**-.213	** .248	.033	** .519	-.18	*-.155	.114
Pairs C	.147	**1	**-.312	** .332	.095	.045	.104	.088	.031	.25	.025	.011
Aud/Vis A	.132	.132	** 1	**-.805	.141	**-.651	.086	-.105	* .173	**-.494	*-.179	.151
Aud/Vis C	*-.187	**.332	** .805	** 1	**-.217	** .528	*-.164	.137	*-.192	** .429	.197	*-.168
2 - 8 A	** .555	.095	.141	**-.217	** 1	**-.233	** .298	-.03	** .464	*-.173	-.151	.049
2 - 8 C	**-.213	.045	**-.651	** .528	**-.233	** 1	**-.232	.151	*-.2	** .509	.145	-.015
Pict A	** .248	.104	.086	*-.164	** .298	**-.232	** 1	**-.406	** .273	*-.198	-.083	* .161
Pict C	.033	.088	-.105	.137	-.03	.151	**-.406	** 1	.007	.143	.052	**-.229
3/Kind A	** .519	.031	* .173	*-.192	** .464	*-.2	** .273	.007	** 1	**-.307	*-.175	* .159
3/Kind C	-.18	.25	**-.494	** .429	*-.173	** .509	*-.198	.143	**-.307	** 1	** .215	-.071
ACTS	*-.155	.025	*-.179	*.197	-.151	.145	-.083	.052	*-.175	** .215	** 1	*-.155
IQ	.114	.011	.151	*-.168	.049	-.015	* .161	**-.229	* .159	-.071	*-.155	** 1

* p < .05 (.155)

** p < .01 (.205)

committed 2-8 with number committed 3/kind (+); and number correct pictures with number committed pictures (-).

A multiple regression analysis was done to determine which of the attention tasks was the best predictor of the ACTS score. The overall analysis was not significant for the five attention tasks. The only significant Beta coefficient was for the number correct of the Auditory/Visual Task.

The observational phase of this study yielded a time-on-task mean of 85.86% with a standard deviation of 14.02. Means and standard deviations of the attention tasks, as well as those of the ACTS and IQ's are listed in Table 2.

Table 2

Means and Standard Deviations for Attention Tasks, ACTS, and IQ

	Mean	Standard Deviation
Pairs A	34.25	9.04
Pairs C	1.006	1.425
Aud/Vis A	48.57	3.489
Aud/Vis C	5.744	6.347
2 - 8 A	6.719	2.096
2 - 8 C	.05	.486
Pict A	9.157	2.64
Pict C	4.78	15.83
3/Kind A	3.719	1.342
3/Kind C	.225	1.021
ACTS	6.475	7.051
IQ	59.922	26.5

Note: The IQ scores are percentiles. All other scores were raw scores.

Note: Tasks labeled "A" refer to the scores of number correct; and "C" to the number committed.

Chapter IV

Discussion

Discussion of the Results

The main goal of this project was to test the validity of several locally developed attention tasks through correlational analysis. Although the results are in the expected direction, some of the relationships, especially with the ACTS, are not as strong as originally anticipated. A possible explanation for this may be due to the inherent characteristics of the abbreviated teacher scale itself. While validity checks on this instrument have mixed results, it was necessary to use the abbreviated form rather than the Conner's long form due to availability and teacher's time constraints. The abbreviated form has, however, been found sensitive to, and useful for measuring the effects of drug treatment for ADHD children. Another consideration is that since the scale was developed prior to DSM-III-R, it was developed as an index of hyperactivity rather than as a measure of attention, which was the intent of the in-house attention tasks. While attention and hyperactivity can be expected to correlate to some degree, they are not presumed to be the same thing.

Although the correlations with ACTS are low, half of them did reach the level required for significance. Also, the hope is that by the end of the third grade, most children with a serious attention problem have been

identified and are probably on medication, thereby limiting the range of scores somewhat.

The relationship between ACTS and the committed scores of the 3/kind task and the aud/vis task tended to be somewhat stronger than the other task's relationships with ACTS. Since the number of committed marks may be due, at least in part, to impulsivity, it would follow that a higher hyperactivity rating would have a positive relationship with a higher committed score, since hyperactivity and impulsivity often appear together. The committed score on the picture task proved to be an exception in that the correlation with ACTS was low. However, this score had a higher negative correlation with intelligence, suggesting that intelligence may be more of a confounding factor on this task than attention. On the regression analysis, we see that IQ has more of a predictive value with the number committed pictures than the ACTS does. The pictures task was deemed more complex than the other tasks, in that it involved switching attention from one stimuli to another, and may have been confounded with visual tracking. Although this task did correlate significantly with the tasks designed to measure visual vigilance, the strength of the relationship was less than that among the less involved tasks.

Of course, the possibility that the in-house developed measures may not be as sensitive to attention-deficit as

believed, must be considered. The pairs task, the 2-8 task and 3/kind task were all developed to measure visual vigilance. These three tasks did, when compared to each other, all have correlations above .45. They are very similar to tasks used in research, i.e., the Continuous Performance Tasks, and in clinical settings (Gordon's Diagnostic System) that have been shown to effectively discriminate between children diagnosed as ADHD and "normals". The primary differences are (a) that the afore-mentioned tasks are computer-based where the local tasks are paper-pencil tasks, and (b) the amount of time required to complete the tasks, i.e., increased attention demands. This latter difference may be a valid concern, and it would be of interest, if these tasks will be used in the future, to look at this factor, i.e., compare a task requiring 10 minutes or more to the tasks requiring attending for five minutes or less.

The aud/vis task differed from the other tasks in that it required both auditory and visual attending. This task tended to have stronger relationships with the committed scores of the other tasks than with the number correct scored. This may be because there wasn't a lot of variance in the scores, i.e., out of 50, the average child got more than 48 correct for the aud/vis task, and limited variance was also seen on number committed scores. The very high negative correlation between number correct aud/vis and

number committed aud/vis may be explained by the idea that if a child lost his/her place while following visually what he was hearing auditorily, the probability of omitting marking those that did not match was high, as was the probability of marking those that did match, as he would hear unmatched letters if he were not visually in the proper place on the page. The same rationale could be used to explain the higher correlation between number correct pictures and number committed pictures, i.e., if the child was "off-track" on one of the pages, the likelihood that he would mark a correctly matched picture as "unmatched" is high. Although the tendency to not mark "not matched" pictures wouldn't be quite as high.

Another goal of this project was to serve as a pilot study in the norming of on-task behavior and locally developed attention tasks. In this endeavor the project has been successful. Local norms on these measures provide a means of comparing the performance of students referred with attention/distractibility difficulty, with those of "average" students in Hampton schools. This could be used as a tool to assist in identifying children with Attention deficit-Hyperactivity Disorder, and could be potentially useful information to forward to school officials, parents and physicians.

Conclusion

The attention tasks appear to hold promise in assisting with the diagnosis of ADHD. This project is seen as a first step in that direction. The in-house measures may need to be adjusted somewhat, i.e., made to increase the amount of time to attend and to decrease the confounding with visual tracking. A study of test-retest reliability is encouraged and more studies of validity are necessary to ensure that the tasks do indeed measure what they were designed to. If at all possible, it is recommended that the observational data be gathered on the same subjects as participated in the performance-task norming so as to include that information in the analysis.

The Psychology Department at Hampton City Schools is encouraged to pursue this avenue of potentially identifying and ultimately designing intervention techniques to assist ADHD students in their schools.

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Appendix A

Random Numbers for use with the Pairs, 2-8, and 3/kind Attention Tasks

8 5 9 6 7 7 3 1 5 2 1 4 1 1 8 5 2 8 5 3 6 9 0 0 0 0 9 3 6 0 0 9 9 5 8

6 2 6 7 8 3 5 6 3 3 1 4 5 0 1 6 2 0 7 4 8 3 5 1 4 5 3 1 1 6 4 9 8 6

6 7 3 8 2 5 0 1 4 1 5 4 6 0 9 6 2 8 3 0 1 8 9 8 6 1 4 1 4 8 3 5 2 5

1 1 3 6 0 4 7 5 3 3 9 1 1 7 3 0 8 5 4 2 3 6 0 6 9 8 4 9 1 7 4 1 2 0

5 5 1 3 7 8 9 5 9 3 5 4 7 2 4 7 6 9 0 9 4 0 4 7 6 5 4 8 0 5 3 9 3 9

9 7 3 6 6 3 9 9 4 1 2 1 2 2 5 9 3 6 2 9 1 9 5 7 4 3 3 4 1 3 5 6 0 8

5 1 9 0 4 7 4 4 1 4 6 9 1 6 8 1 2 8 1 6 5 2 4 5 5 5 4 2 7 9 3 1 2 2

0 9 5 3 2 8 5 6 9 6 4 1 0 9 0 9 4 9 7 7 6 2 3 5 4 1 3 8 3 3 1 5 5 5

9 0 0 6 1 9 2 2 9 0 9 2 9 5 6 3 2 5 2 5 4 1 6 2 1 0 8 9 7 1 7 6 5 9

6 6 7 4 6 2 4 3 6 3 4 8 4 4 0 1 8 6 4 7 3 2 9 3 5 8 9 2 8 7 8 5 0 2

4 3 5 9 9 9 4 1 0 7 7 3 1 9 7 3 4 0 8 5 8 9 9 3 6 1 0 9 8 0 4 3 9 3

5 8 4 7 2 5 8 6 5 7 6 8 6 9 4 4 9 3 2 9 6 1 0 0 8 1 8 2 4 5 4 7 6 8

9 7 5 1 0 3 2 4 1 5 4 5 7 4 1 0 5 9 6 6 4 5 6 4 7 6 7 9 6 6 8 1 0 1

8 4 6 0 2 1 4 4 9 3 6 5 5 1 5 1 9 2 5 1 4 1 6 4 2 6 7 4 3 4 4 1 0 4

3 0 4 7 6 1 7 3 6 9 3 2 4 6 7 2 8 7 1 1 8 3 3 6 3 4 5 4 1 4 0 4 8 1

2 7 6 6 6 8 8 1 6 3 7 6 4 3 1 9 9 5 9 5 7 5 5 0 4 9 6 2 0 9 8 4 8 0

0 6 7 2 5 7 1 8 6 7 1 9 2 0 7 9 4 6 7 8 4 6 6 1 2 5 9 4 9 3 2 6 4 4

2 7 5 5 7 6 6 9 6 6 6 5 8 3 0 8 1 8 5 8 3 5 3 2 9 1 8 7 4 0 3 5 0 6

7 3 6 0 3 3 4 0 7 5 1 6 4 5 1 4 2 8 8 5 0 3 4 4 8 3 7 3 9 0 9 6 3 2

2 0 1 7 6 1 2 6 5 5 2 2 8 0 6 0 7 1 9 1 8 4 6 4 1 6 4 6 6 9 6 2 8 2

8 1 6 3 6 3 4 9 5 0 3 7 8 6 0 2 4 0 7 0 6 0 9 8 9 2 9 1 7 4 0 4 3 4

2 8 2 1 7 5 0 4 4 7 0 7 8 7 5 4 9 0 7 7 5 7 5 0 8 5 5 5 5 5 8 1 5 5

0 3 8 2 5 4 7 1 7 6 1 0 7 9 0 8 3 2 1 0 8 1 9 5 6 7 9 7 3 3 7 5 1 0

Appendix B

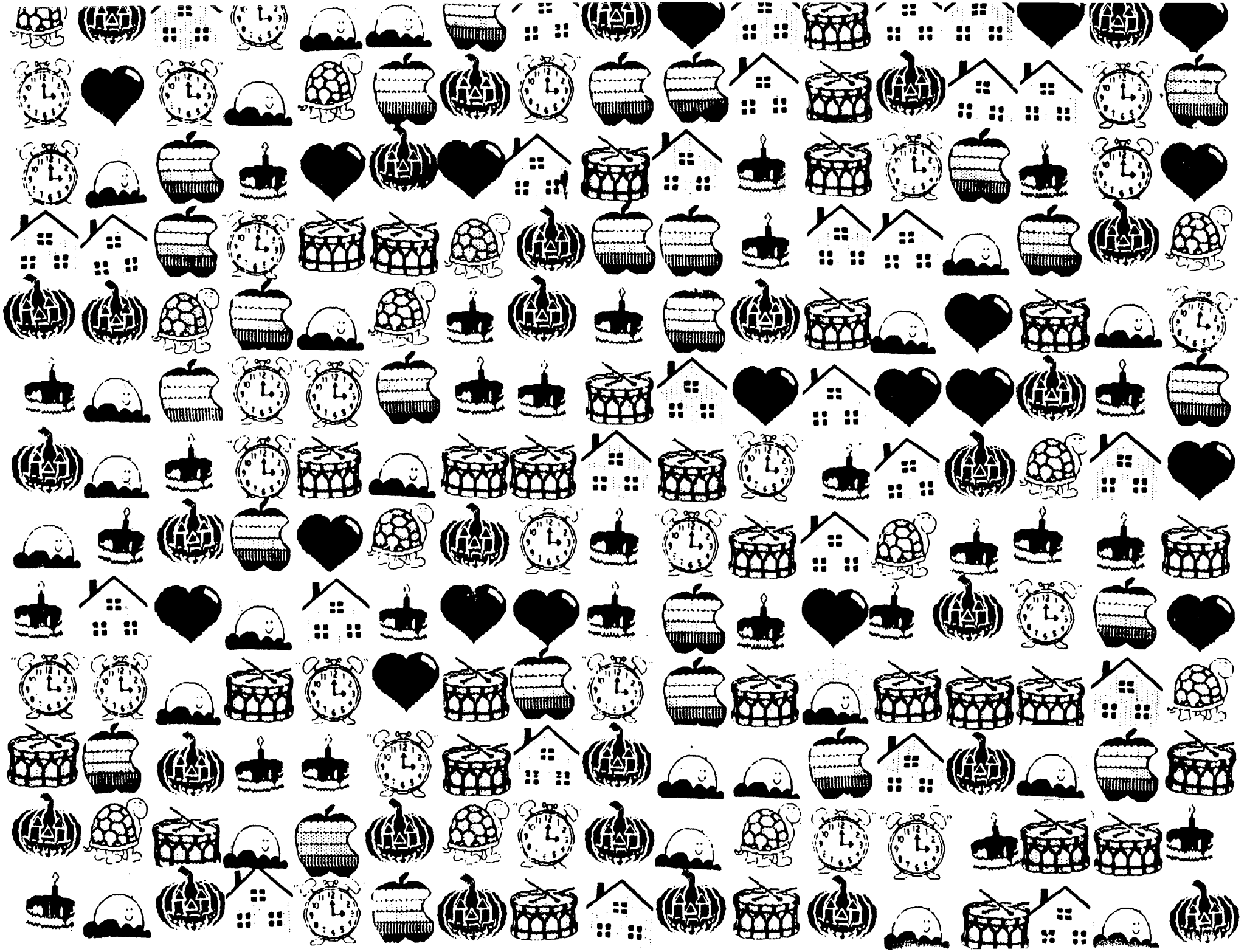
Random letters for use with the Audio/Visual Attention Task

1.	K	B	L	F	B	E	G	R	L	N	X	F	H	B	F
2.	H	I	C	F	M	C	U	W	A	E	G	L	P	V	W
3.	F	Y	G	I	W	S	J	K	B	C	O	Y	Y	E	V
4.	W	K	L	C	N	G	I	B	N	Q	K	N	J	A	W
5.	A	W	Y	M	E	U	I	U	E	D	R	L	W	Q	T
6.	V	K	W	G	U	P	P	G	Y	W	J	Z	A	L	C
7.	T	S	E	U	K	M	Y	L	A	E	V	B	N	K	J
8.	P	N	Y	F	K	F	H	W	U	B	J	Y	F	A	Q
9.	Y	W	I	A	Y	R	K	C	X	W	B	L	Y	G	R
10.	R	I	J	F	I	P	U	A	H	K	N	R	A	L	N

Appendix C

Random Pictures for use with the Pictures Attention Task

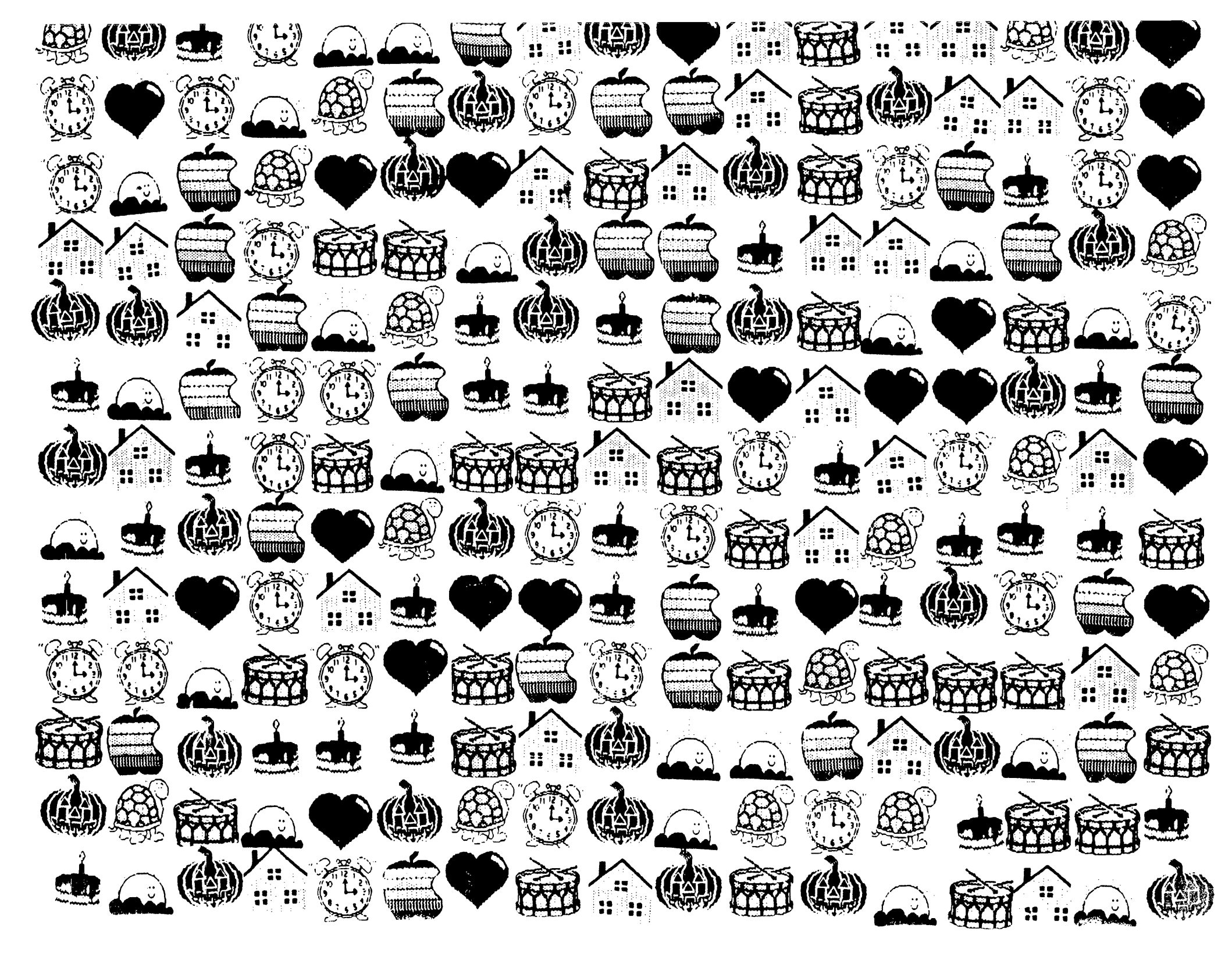
Note: This sheet was one on the pages in the student's booklet. For the comparison copy that was laminated for the purposes of this study see Appendix D.



Appendix D

Random Pictures for use with Pictures Attention Task

Note: This sheet served as the comparison page for the purposes of this study and was laminated to avoid confusion with the similar page in the student's booklets.



Appendix E

Observation Data Sheets

NAME: _____

SCHOOL: _____

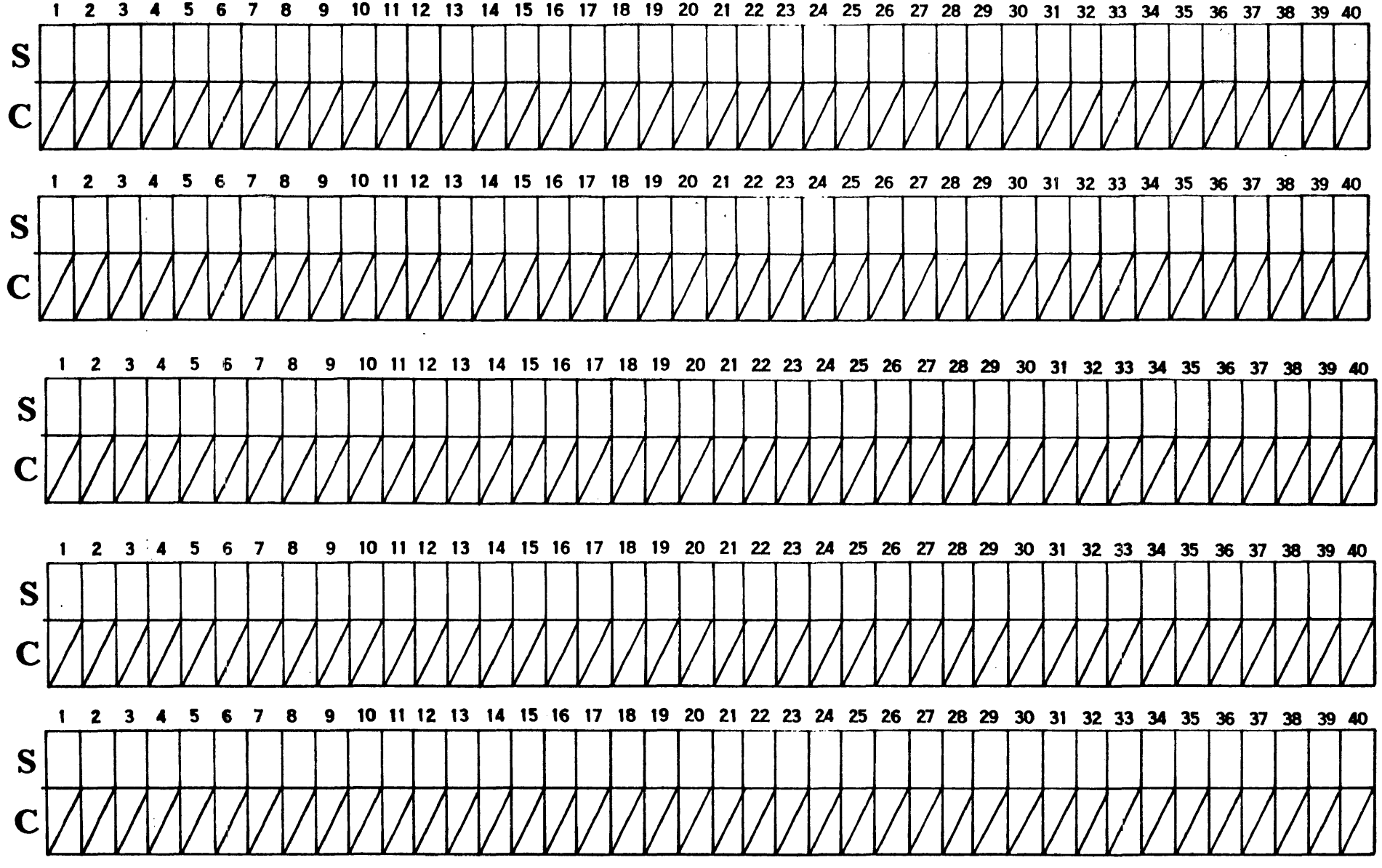
TEACHER: _____

GRADE: _____

ROOM NUMBER: _____

OBSERVER: _____

DATE: _____



SBO Form 238 (New-May 85)

OBSERVE FOR 20 SECONDS THEN RECORD FOR 10