Concept attainment : a case study comparing a child profiled with Asperger Syndrome and his fifth grade classmates
by Marilyn Sue Hamilton

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor in Education in 'Education
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Abstract:
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Qualitative methods including field notes, interviews, videotapes, audiotapes, and electronic-mail were used for data collection. The subject and his peers were instructed using a visual presentation of the concept attainment model in spelling and math during the first week. Scores were recorded and the subject was given individual one-on-one instruction in a imagery/visualization method outside the classroom.

During the second week of the investigation, all of the students in the classroom were instructed using the concept attainment method in spelling and math using oral instructions with an abstract visual cue for two days, oral instructions with visual answers for one day, and visual instructions with visual answers for one day. All of the students were pretested, post tested, and retested to determine immediate and/or long term changes in their responses. Follow-up interviews were conducted with parents and teachers to determine the impact of using the concept attainment model with the child identified as having Asperger Syndrome.

Results indicated that the child with Asperger Syndrome in this study generated fifty percent fewer written language responses than his same-aged peers when the modified concept attainment model was presented in the regular classroom setting.

Gains made on the pretest, post test, and retest could not be attributed to the presentation style of the model given the student’s limited written language ability and difficulty attending to relevant stimuli. The visual/imagery method used in this study did not yield any results with the subject in the regular classroom but during one-on-one sessions, the child was able to organize his language more succinctly when directed through the visual/imagery approach.

CONCEPT ATTAINMENT: A CASE STUDY COMPARING A CHILD PROFILED WITH ASPERGER SYNDROME AND HIS FIFTH GRADE CLASSMATES

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Marilyn Sue Hamilton

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APPROVAL

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This dissertation has been read by each member of the dissertation committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

This qualitative single subject case study investigated how the relationship of modifying a concept attainment model in a regular fifth grade classroom affected a child identified with Asperger Syndrome, a neurodevelopmental disorder, in relationship to his peers. The subject used in this study was an eleven-year-old male who had been previously profiled as possibly having Asperger Syndrome with a complete battery of psychological tests and a neurological evaluation.

Qualitative methods including field notes, interviews, videotapes, audiotapes, and electronic-mail were used for data collection. The subject and his peers were instructed using a visual presentation of the concept attainment model in spelling and math during the first week. Scores were recorded and the subject was given individual one-on-one instruction in a imagery/visualization method outside the classroom. During the second week of the investigation, all of the students in the classroom were instructed using the concept attainment method in spelling and math using oral instructions with an abstract visual cue for two days, oral instructions with visual answers for one day, and visual instructions with visual answers for one day. All of the students were pretested, post tested, and retested to determine immediate and/or long term changes in their responses. Follow-up interviews were conducted with parents and teachers to determine the impact of using the concept attainment model with the child identified as having Asperger Syndrome.

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CHAPTER 1

INTRODUCTION

Asperger Syndrome is a neurodevelopmental disorder found in all nationalities throughout the world. Since its inclusion in the *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition* (American Psychiatric Association, 1994) and the *International Classification of Diseases* (ICD-10) in 1992, interest in this low incidence disability has increased dramatically (Klin, Volkmar, & Sparrow, 2000). At this time, Asperger Syndrome (AS) is defined under Pervasive Developmental Disorders (PDD) in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV). Hyman, Rodier, and Davidson (2001) note that the increased interest in this disorder may be the result of dramatic changes in the diagnostic criteria for PDD over the last twenty years, an increase in public awareness of autism and related disorders, or the changes in the types and availability of therapeutic and education services for this population.

The diagnostic criteria for Asperger Syndrome (AS) includes qualitative impairments in social interactions as well as restricted repetitive and stereotyped patterns of behavior, interests, and activities. A clinically significant impairment in social, occupational, or other important areas of functioning must be present while no clinically significant delay in language development, cognitive development, the development of age-appropriate self-help skills, adaptive behavior, or curiosity about the environment in childhood is exhibited. The patient cannot meet the criteria for another specific Pervasive Developmental Disorder or Schizophrenia (Attwood, 1998). Because AS shares the triad of dysfunctions found in autism (i.e. communication,

social, and flexibility deficits), it has been considered to be an autistic spectrum disorder, which means that the symptoms manifested by this condition are on a continuum. Many consider low functioning individuals with autism to be on one end of the spectrum and high functioning individuals with autism or Asperger Syndrome to be on the other end. Research indicates that perhaps 20% of individuals with autism function in the normal or above-normal intellectual range cognitively (Klin,Volkmar, & Sparrow, 2000). Children with Asperger Syndrome are also considered to function within the normal or above-normal range of intelligence. Researchers and practitioners recognize that although the vast majority of students with Asperger Syndrome has average to above-average intellectual abilities and is included in general education classrooms, this group experiences academic problems (Myles & Southwick, 1999). Social and communication deficits along with concrete and literal thinking, poor problem-solving and organizational skills, as well as possible obsessive and narrowly defined interests, make learning and teaching difficult for these children and their general education teachers.

According to Myles and Simpson (1998), many students with AS learn information in a style which is incompatible with the way academic material is presented in educational environments. They speculate that students with Asperger Syndrome may possess average ability to process visual as well as auditory information but when asked to process both types of information concurrently, they cannot do so. This study presented information in a visual and oral format to a child with AS in a regular classroom setting to determine any effect.

Efforts to develop a better understanding and description of individual processing abilities in terms of information processing are not new to education. David Hunt and his associates developed a conceptual systems theory in the middle of the twentieth century which described human development as "an interactive function" of a person's level of personality stage and the environmental conditions he encountered. The conceptual systems theory delegated individuals into four behavioral groups: low complexity, moderate complexity, moderately high complexity, and high complexity (Joyce, 1996) The best procedure for inducing an individual to progress toward complexity and flexibility was to match his/her present stage of personality development to an environment tailored to pull the individual toward the next stage of development.

Schroeder, Driver, and Streufert (1967) defined the low complexity level as black and white thinking, concrete, minimizing conflict, and preventing the individual from seeing "grays" or degrees. Moderate complexity was a move away from absolutism and characterized by the delineation of several ways of structuring the world. Moderately high complexity was the individual's ability to see himself in other situations from another point of view and high complexity was a step further toward creating additional schemata in alternate ways. Hunt and his associates found that for optimal growth in complexity, the student needed to be exposed to an environment which matched the characteristics of his or her psychological world. An environment in which a highly complex individual would flourish would create unbearable stress for the person of low complexity. Asperger originally described his syndrome as a personality

abnormality. Social impairments, such as rigidity and literal thinking, which are observed in children, and adults, with AS may be linked with low complexity.

Current learning strategies based on brain research support the conceptual systems theory. Caine and Caine (1997) identify among the twelve brain/mind learning principles that the brain is a complex adaptive system, learning is developmental, and complex learning is enhanced by challenge and inhibited by threat. An emphasis on the development of metacognitive intelligence, the reflection on one's own processes, has become an integral aspect of teaching for the future. One of the methods developed by Joyce and Weil (1996) to enhance metacognitive learning is concept attainment, the acquisition of concepts and an analysis of the process. It has also been recommended by Sousa (2001a) as a strategy for enhancing thinking.

Persons with Asperger Syndrome may exhibit difficulty with problem solving if abstract concepts are involved. Categorization, concept formation, and concept attainment are important aspects of problem solving. Categorization is the organization of data, and concept formation is the way in which a vast amount of data is organized into various ideas. The concept attainment model requires a student to figure out the attributes of a category that is already formed in another person's mind by comparing and contrasting examples (called exemplars) that contain the characteristics (called attributes) of the concept with examples that do not contain those attributes (Joyce and Weil, 1996).

Statement of the Problem

In a recent article reviewing current research regarding Asperger Syndrome (AS), it is noted that "a significant challenge facing these individuals is their difficulty generalizing knowledge and skills" (Barnhill, 2001a, p.7). This characteristic is typical of disorders included along the autistic spectrum. Strategies used by children with autism were often idiosyncratic, limited, and stereotypic in nature.

One strategy thought to help integrate information for better generalization is the concept attainment model. The problem prompting the present qualitative study is how the relationship of the modification of a strategy used in a regular classroom setting affects the child identified with Asperger Syndrome. This study presented information through a structured concept attainment model first visually then orally in the classroom while providing the student with Asperger Syndrome the instruction of imagery/visualization as an additional strategy to enhance auditory problem solving.

Problem-solving skills, concepts and helpful behavioral routines are considered essential elements to be taught in an explicit and sometimes rote fashion using a parts-to-whole approach to children identified with Asperger Syndrome (Klin, Volkmar & Sparrow, 2000). Learning strategies, techniques, principles, or rules that aid in problem-solving, have been investigated for many years in the field of education for normally developing children as well as children with learning disabilities and developmental disabilities (Leon & Pepe, 1983; McCormick, Miller, & Pressley, 1989). The data collected through this study were intended to add to the literature regarding the difficulties in applying a specific strategy for children identified with Asperger

Syndrome.

The three phase model of concept attainment devised by Joyce and Weil (1996) involved the presentation of data and identification of concepts, testing attainment of the concept, and analysis of thinking strategies. Tennyson and Cocchiarella (1986) suggested that students develop procedural knowledge (how to attain concepts) with practice and the more procedural knowledge the students possess, the more effectively they attain and can apply conceptual knowledge. This model required students to compare positive and negative exemplars visually and orally, develop hypotheses, and readjust their hypotheses regarding new information through feedback from the teacher about their generated examples in order to analyze their thinking .

Purpose of the Study

The purpose of this case study was to investigate the implementation of the concept attainment model using visual and auditory methods in the classroom as well as teach the child with Asperger Syndrome to use a visual imagery strategy as an aid in problem solving with auditory input. The study used exemplars written by regular classroom teachers and the researcher to be used in the regular classroom. The model was used in a regular classroom setting using visual presentation during the first week of instruction, and then the auditory presentation was employed during the second week of instruction.

In order to answer the research question, does visual and/or auditory presentation affect concept attainment in children identified with Asperger Syndrome, qualitative methods were used to determine the effect on the child identified with Asperger

Syndrome in the study. The subject, parents, and teachers were interviewed to determine what changes were observed during the study, how each person thought learning the concept attainment model affected the child, and if the child was performing better in the regular classroom. The subject was interviewed to determine if the visual/imagery method helped him during the second week of the study.

Questions to be Answered

1. Does training using visual and/or auditory presentation affect concept attainment in a child identified with Asperger Syndrome?

2. Can the visual/imagery concept attainment strategy taught to a child identified with Asperger Syndrome be generalized into the regular classroom setting?

3. How does using this intervention in the regular classroom affect teachers, parents, children in the classroom, and the subject identified with Asperger Syndrome?

Definition of Terms

Asperger Syndrome. (AS)- a neurodevelopmental disorder which follows the behavioral guidelines of the DSM-IV or ICD-10.

Children and adults with Asperger Syndrome may exhibit behaviors associated with other disorders which are unlike their peers. Some of those disorders are defined here:

Attention Deficit with Hyperactivity Disorder (ADHD)-a neurological disorder which manifests itself in lack of attention and hyperactivity. Many children and adults identified with Asperger Syndrome may also be diagnosed with ADHD (Attwood, 1998; Ghaziuddin, Weidner-Mikhail, & Ghaziuddin, 1998).

Theory of mind (ToMM)- the main way in which human beings are believed to make sense of actions in other animate beings (Baron-Cohen, 1997). Research indicates that most children with autism do not develop a theory of mind (Baron-Cohen, 1999).

Learning Disability (LD)- a chronic condition which has been presumed to have a neurological origin and results in an interference with development, integration, and/or demonstration of verbal and/or non-verbal activities (Feusahrens, 1992).

Effective approaches for intervention with students identified as having learning disabilities include testing, describing the learning strategy, modeling the strategy, verbal rehearsal of the strategy, practice with controlled activities, feedback, and practice using grade-appropriate activities (Deshler, Warner, Schumaker, & Alley, 1983). These approaches may also be considered effective with students identified with AS.

Testing- Testing involves establishing a baseline of student performance.

Describing the learning strategy- The teacher describes to the student the steps involved in the target strategy.

Modeling the strategy - The teacher can model the strategy by verbally stating the problem solving process in this study.

Verbal rehearsal of the strategy -The student verbally rehearses the steps involved in the strategy.

Practice with controlled activities - The student practices applying the strategy with appropriate instructional materials.

Feedback - As the student applies the strategy, the teacher gives the student both

positive and corrective feedback.

Practice with grade-appropriate activities - Students practice the strategy in the regular classroom setting.

Significance of the Study

Research on Asperger Syndrome is emerging. One of the reasons accounting for the emergence of AS related support organizations has been the perception of a void of services for and knowledge about more able children and adolescents with severe social disabilities (Klin, Volkmar, and Sparrow, 2000). These children often fall between two categories of service, learning disabilities and autism. This gap has led to a failure of schools to recognize the unique problems posed by this population and to deny services because these students seem to be too bright or appear to be doing well academically. Myles and Simpson (1998) noted that teachers often fail to acknowledge the special academic needs of students with AS because the children give the impression that they know more than they do. Their pedantic verbal abilities and perceived eccentricities have been considered curious rather than handicapping.

This case study conducted in a rural regular classroom setting was designed to add to the literature on children with AS in the public school environment. As with all developmental disabilities, each child with AS is unique and requires an individual treatment program. The unique education problems presented through this document are limited in their generalization to any other school environment.

Methodology

A qualitative single subject case study design was employed in this study. An eleven-year-old male enrolled in public school was used as the subject. The child was

selected for the study because he had been profiled as a child with Asperger Syndrome by a board certified neurologist, scored in the normal range of intelligence on the Wechsler Intelligence Scale for Children- III (WISC-III), and had a significantly low score on the arithmetic portion of this instrument.

Because this investigation was conducted in the classroom environment and employed a qualitative structure, it was considered a field-based study. "The normative quality of the work of research makes it especially potent when applied in schools because schools are designed to impose ideas and work patterns upon children" (Popkewitz, 1984, p.24). Jensen (1998) identified this type of research in education as the most reliable in interpreting brain research because it gives us testing results under actual, real-life conditions.

The child was instructed using a modified concept attainment model in the regular classroom along with his peers and a visual/imagery method as a support strategy in a one-on-one setting. Audiotapes, videotapes, and field notes were used to determine the effect of the strategy on the child in the classroom, the visual/imagery support strategy in isolation, and the perceptions of the parents and teachers involved in the study.

The motivation for this study was the increased interest in the identification of children in the public school environment with Asperger Syndrome. This study attempted to describe and analyze the performance of the child identified with AS in relationship to his peers when a new strategy was introduced in their classroom.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

An issue in developing appropriate educational treatment programs for children identified with AS is that the criteria for defining the disorder are controversial. Barnhill (2001a) suggests that "no universal agreement exists on the characteristics of AS"(p.3). The review of literature for this study was divided into five categories: (1) historical definition of AS, (2) clinical definition of AS, (3) current definition of AS, (4) educational implications, and (5) strategy instruction for children with other neurodevelopmental or processing disorders..

Historical Definition of AS

Asperger (1944), a Viennese physician, identified a group of children with a disorder he called autistic psychopathy in a published paper, "Autistic Psychopathy in Childhood." The paper was translated into English in 1991 (Mayes, Calhoun, and Crites, 2001). The children he studied had deficits in academics, social integration, and behavior management. A year earlier, unknown to Asperger, Kanner (1943) identified a group of eleven children exhibiting similar characteristics as having early infantile autism. Kanner's description became accepted in the English speaking community as the definition of autism but it was not until 1980 that it was formally recognized as a diagnosis (Klin, Volkmar, and Sparrow, 2000). Wing (1981) published a review of Asperger's work reporting on thirty-four cases of individuals with similar histories and clinical presentations. It was Wing who proposed the label, Asperger Syndrome, in an

effort to avoid the term psychopathy. At that time psychopathy referred to sociopathic behavior rather than personality abnormality which had been Asperger's intent (Klin, Volkmar, and Sparrow, 2000). Wing's description varied slightly from Asperger's original case reports in the areas of language and creativity. She did not differentiate between AS and autism but indicated Van Krevelen (1971) agreed with Asperger that the two disorders should be considered different (Wing, 1981). Current researchers and practitioners have been challenged to identify and validate common characteristics found in this population.

Clinical Definition of AS

When Klin, Volkmar, and Sparrow (2000) reviewed six major sources for clinical criteria, fifty percent excluded autism from the clinical diagnosis (Asperger, 1944; Szatmari et al., 1989; DSM-IV, 1994) and fifty percent included autism as part of the diagnostic criteria (Gillberg and Gillberg, 1989; Tantam, 1988a; Wing, 1981). All six sources agreed on only one clinical characteristic: social impairment including poor nonverbal communication, poor empathy and failure to develop friendship (Klin, Volkmar, and Sparrow, 2000).

Prior to its inclusion in the DSM-IV, definitions of Asperger's Syndrome included impaired social interaction, restricted and repetitive behavior and interests, and communication impairment (Gillberg, 1985; Gillberg and Gillberg, 1989; Szatmari, 1991; Szatmari, Tuff, Finlayson and Bartolucci, 1990; Tantam, 1988a; Wing, 1981). There was little consensus about the differences between Asperger Syndrome and autism due to the varying and broad qualitative definitions determined by individual

researchers and clinicians (Mayes, Calhoun, and Crites, 2001). References to the two disorders included Asperger Syndrome as on the autism spectrum or continuum (Klin, 1994; Wing, 1986). High functioning autism was also used to describe the syndrome (Schopler, 1985; Szatmari, Bartolucci, and Bremner, 1989).

After the inclusion of the Asperger Syndrome in the ICD-10 (World Health Organization, 1992), it was considered for inclusion in the DSM-IV. The criteria for the DSM-IV differed from previous literature in that it did not specify that individuals with Asperger's disorder were less socially impaired than individuals with autism. The DSM-IV's definition for social impairment criteria for Asperger Syndrome and autism are the same. The DSM-IV also did not include communication impairment as a symptom of the disorder and included absence of significant cognitive delay and language delay to the criteria (Mayes, Calhoun, and Crites, 2001). This difference in definition continues to cause controversy among researchers and clinicians.

Current Definition of AS

Despite the DSM-IV's definition, researchers continue to describe individuals with Asperger Syndrome as being less severely affected than individuals with autism (Eisenmajer et al., 1996; Szatmari, 1991). Speech and language delays as well as gross motor impairments are still considered questionable (Eisenmajer et al.,1996; Manjiviona & Prior, 1995).

Wing consistently argues that AS should not be considered a separate entity from autism (Klin, Volkmar & Sparrow 2000). In clinical studies over the last ten years, information has been collected on nearly 700 children and adults with autistic

spectrum disorders. The conclusions of these studies indicate that (1) any of the features described by Kanner can occur in individuals who fit under Asperger's description, (2) the clinical picture of these individuals changes with age, and (3) different types of autistic spectrum disorders can be found within one family (Klin, Volkmar, & Sparrow, 2000).

Several studies have questioned the possibility of diagnosing Asperger Syndrome clinically (Eisenmajer et al., 1996; Manjiviona and Prior, 1995; Szatmari, 1991; Mayes, Calhoun, and Crites, 2001). In a study of 157 children with clinical diagnoses of autism or Asperger's disorder, all children diagnosed with AS were included in the DSM-IV's definition of autism (Mayes, Calhoun, and Crites, 2001). The authors concluded that it would be unlikely or impossible to differentiate the diagnosis of AS using the DSM-IV's criteria.

Educational Implications

A recent study conducted by the Asperger Syndrome Project at the University of Kansas provided a series of studies which are the first of their kind to be published regarding the characteristics of Asperger Syndrome. This collection of studies using between 16 and 42 subjects identified with AS produced the following characteristics: Intelligence which is similar to the general population's, ranging from Intellectually Deficient to Very Superior; a significant differentiation between written and oral language skills; limited ability to problem solve, which is in marked contrast to their verbalizations; grade-appropriate word calling with problems in inferential comprehension; pronounced emotional difficulties recognized by parents and teachers

but not acknowledged by the students themselves; attributions that resemble a learned helplessness approach; and sensory problems similar to persons who function cognitively at a much lower level (Barnhill, 2001b). Previously, Barnhill (2001a) had identified essential features in AS which included social impairments, communication impairments, and restricted range of interests and rigidity. She also included motor clumsiness, emotional difficulties, sensory characteristics, and academic difficulties as characteristics.

Emotional difficulties have been documented in terms of adolescents and young adults with AS regarding depression and anxiety (Attwood, 1998; Ghaziuddin, Weidner-Mikhail, and Ghaziuddin, 1998; Gillberg, 1985; Tantam, 1988b; Wing, 1981). Among half of Ghaziuddin's participants with AS, there was an additional psychiatric diagnosis at the time of evaluation. Attention Deficit Hyperactivity Disorder was the most common diagnosis for children while adolescents and adults exhibited depression.

Peculiar sensory responses have been observed in children diagnosed with AS (Church, Alisanski, and Amanullah, 2000; Myles and Simpson, 1998). Frequently, there is a heightened or over-exaggerated response to touch and an intolerance to bright or flickering lights (Barnhill, 2001a). Children with AS may demonstrate academic difficulties because they lack higher level thinking and comprehension skills. They tend to be very literal in their interpretations was well as factual (Williams, 2001). These students struggle in their ability to generalize knowledge and skills. They often have difficulty applying information and skills across settings and with different individuals (Myles and Simpson, 1998). This failure to apply knowledge and skills may be linked

to poor processing abilities. "Many students with AS learn and process information in a style that is generally incompatible with the way academic material is presented in many classrooms" (Myles and Simpson, 1998, p. 47). Although they may have at least average abilities to process visual and auditory information, children with AS may have difficulty processing both types of information at the same time.

In the past, the term learning disability referred to a learning problem that was caused by disorders in the psychological processes (LD Summit, 2001). These disorders have been considered to result from a dysfunction of the central nervous system. There has been, however, little consensus about the deficient processes or how to measure them. For the purpose of this study, the qualities found in effective strategies for children diagnosed with learning disabilities and autism will be considered viable for children diagnosed with AS.

Strategy Instruction

Successful students learn about themselves and their learning through academic experiences. Students with processing deficits seem to profit less from their academic experiences. Consistent failure does not provide information about what the learning disabled learner should do strategically to ensure success. Without appropriate strategy reinforcement, learning disabled learners become convinced that nothing they do will change their academic fate (McCormick, Miller, and Pressley, 1989). This situation leads to poor motivation and attention which in turn continues the cycle of failure.

Dale Schunk (1983) and colleagues demonstrated the benefits of training students to approach tasks strategically. Schunk trained math-disabled students to set

small, easily attainable goals and administer self-rewards. Learning to approach tasks strategically improved student expectations, perceived self-efficacy, and math skills. Similar findings were obtained from a study designed to train LD adolescents to set realistic goals (Tollefson, Tracey, Johnson, Farmer, and Buenning, 1984).

Research indicates that simply teaching cognitive skills will not alter the profile of the LD student. Teaching only metacognitive strategies and changing attributional profiles may produce short term gains, but long term significance needs continued research (McCormick, Miller, & Pressley, 1989). Currently, the most effective programs for students with learning disabilities are those designed to improve all three domains (cognitive, metacognitive, and motivational) simultaneously (Arbitman-Smith & Haywood, 1980; Deshler, Warner, Schumaker, and Alley, 1983). The strategy used for this study has attempted to employ cognitive, metacognitive, and motivational aspects.

Simpson and Regan (1986) identified three common characteristics among children with autism which differentiated them from other learners: stimulus overselectivity, diminished motivation, and self-stimulatory responses. All three of these characteristics may also be seen in children with Asperger Syndrome.

Stimulus overselectivity is the limited consideration of environmental stimuli (Dunlap & Koegel, 1981; Lovaas, Schreibman and Koegel, 1974). Generalization of learned responses is often inhibited in children with autism due to stimulus overselectivity (Bock, 1990). Rincover and Koegel (1975) reported the failure of four out of ten children with autism to generalize a response learned in one setting to another

setting. Conclusions from this study indicated that the failure of the children to generalize was due to a continued reliance upon irrelevant stimuli as prompts.

Diminished motivation in children with autism is characterized by a tendency to impose rigid routines on all activities. This results in an unwillingness to investigate new environments, develop new areas of interest, or learn alternative responses to environmental stimuli (Bock, 1990). Diminished motivation reduces the number of correct response elicited which results in a weak association between correct responses and reinforcers (Koegel & Egel, 1979). Koegel and Egel (1979) investigated the influence of correct versus incorrect task completion on the motivation of children with autism to respond to instructional activities. They concluded from their study that the learning characteristics of children with autism may result in few or inconsistent reinforcement opportunities resulting in decreased motivation, but treatment procedures designed to keep children responding until they complete a task may result in increased motivation through reinforced perseverance.

Self-stimulatory responses are repetitive, stereotyped, idiosyncratic motor behaviors which appear to have no functional relationship with the environment (Lovaas, 1981). Dunlap, Dyer and Koegel (1983) conducted a study investigating the relationship of short versus long intertrial intervals to correct responses and self-stimulatory behaviors in children with autism. Given any child/task combination, short intertrial intervals produced decreased levels of self-stimulatory responding and increased levels of correct responding (Bock, 1990).

Intervention has been found effective in treating some of the core learning

deficits exhibited by children with autism. These interventions, or learned responses, are limited only if they cannot be generalized and maintained. Research indicates that learned responses by children with autism can be enhanced by (1) the use of functional reinforcers to train the targeted responses, (2) use of multiple therapists to train the targeted responses, and (3) training the targeted responses in a number of settings (Bock, 1990) The methodology used in this study attempted to incorporate these procedures.

Strategic training for children with autism has been documented by Bock (1990, 1999). Bock investigated the effects of categorization strategy training on the performance of four children with autism. Three of the four children generalized use of the strategy to sorting activities involving unrelated, untrained sorting items. In 1999, the study was extended to include (a) the use of authentic sorting activities for categorization strategy training, (b) the use of both low and high-functioning children with autism, and (c) the assessment of categorization strategy generalizations across multiple settings using untrained sorting items and different teachers (Bock, 1999). The data indicated that both high and low functioning children with autism could benefit from categorization strategy training; however, because participants did not receive strategy training across a set of natural settings, the potential correlation between learning strategy generalization, maintenance, and general case instruction remained unclear and warranted further research.

The review of literature supports the difficulty in diagnosing and treating the AS population. While there continues to be controversy regarding the differences between

autism and AS, children are being diagnosed with this disorder without the benefit of appropriate educational placements or programs. What effect, visual and/or oral strategic instruction, would produce on the subject was the intent of this investigation.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this case study was to investigate the implementation of the concept attainment model using visual and auditory methods in the classroom as well as teaching the child with Asperger Syndrome to use the imagery/visualization as an aid in problem solving with auditory input.

Research Design

This study employed a qualitative single subject case study design. The purpose of a single subject design is to clearly establish the effects of an intervention on a single individual (Neuman and McCormick, 1995). A qualitative case study provides a dynamic holistic description and analysis of a single phenomenon or social unit (Merriam, 1988). "Single subject research is by its very nature personal and individualized, which in turn lends itself to qualitative research procedures" (Richards, Taylor, Ramasamy, and Richards, 1999, p. 285). Denzin and Lincoln (1994) state that qualitative researchers investigate events in their natural settings, and attempt to interpret phenomena in terms of the meanings that the people involved place on them. In qualitative research, the experiences and reactions of the individual researcher as well as other participants, including the individual subject, are very important.

McWilliam (1991) identified several guidelines for qualitative single subject research. He noted that a sufficient amount of time needed to be arranged for adequate information gathering in order to accurately interpret qualitative data. The investigator,

too, must be involved in the study and familiar with the individuals who are subjects, as well as those who may be involved in collecting data and applying the treatment variable, and those whose lives may be affected by the outcomes, such as the family. McWilliam also suggested that if the researcher is distant, he or she might be unable to relate certain interpretations by others. The researcher must be prepared to collect data on variables that are unexpected as the study develops. Burgess (1985) characterized qualitative research by its flexibility and the fact that studies could be designed and redesigned.

The study of a culture, like the classroom, "provides the framework for examining what the child knows and how the child processes information and responds to cues in the environment, but equally significant, it also provides the framework for examining how teachers process information concerning learner attributes, cognitive behaviors, and emotional signals" (Wolf & Tymitz, 1977, p.9). A qualitative single subject case design was chosen for this study because Asperger Syndrome is considered a low incidence disability. Only three students in this small rural school district of 958 had been medically diagnosed with Asperger Syndrome. Given the time period for the study and the involvement of the regular classroom population, only one of the families chose to be involved in the study.

This particular case study is considered a bounded system. Bounded systems are those in which the limits, or bounds, have a sense of obviousness such as an individual teacher or a single school. Creswell (1998) suggested bounded systems were bounded by time and place. Devons and Gluckman (1982) referred to bounded systems as

research wherein an analyst cuts off a manageable field of reality.

Analytic Procedures

Denzin and Lincoln (1994) identified a variety of techniques that are useful in the analysis of qualitative research. Richards, Taylor, Ramasamy, and Richards (1999) delineated their five phases in this manner:

> Phase 1- The researcher examines his or her own multicultural nature and places himself or herself in context historically. Ethics and politics of the research may be included.
> Phase 2- Theoretical paradigms and perspectives are determined and used to support these views. Positivist, postpositivist, constructivist, feminist, ethnic, Marxist, or cultural studies may be included and should not be considered mutually exclusive.
> Phase 3 - Research strategies are identified.
> Phase 4 - Methods of collection and analysis are identified. These may include interviewing; observing; examination of artifacts; documents and records; visual methods; personal experience methods; data management; computer-assisted analysis; and textual analysis.
> Phase 5 -The researcher practices the art of interpretation and presentation. The researcher must identify criteria for judging the adequacy of the research, study the art and politics of interpretation, write interpretively, analyze policy, evaluate traditions, and apply the results (p. 287).

Role of the Researcher and Bias

The investigator in this study had worked in public education for over twenty years. Much of the researcher's career centered around Special Education in three different states, even though she did teach fifth grade for a limited time. During her last three years of teaching, the researcher worked as an inclusion teacher for a small rural school district of approximately 175 children. Inclusion teaching for this school meant that she worked in both a pull out program to help students one-on-one and in the

regular classroom teaching communication skills.

It was during this experience that the researcher became the teacher of a young man who would be diagnosed with Asperger Syndrome. In 1994, there was no mention of Asperger Syndrome in the educational literature.

After working with this student for a year, the researcher was able to form a special bond with him. He was the most unique learner with whom she had ever worked. His rote memory capabilities were remarkable. He could remember every current statistic for the National Basketball Association without hesitation. His parents were travelers and took him to many countries where he could remember in great detail all of the places, money, and foods he had experienced and, yet, this remarkable young person could not remember how to make change from a $5.00 bill. These areas of functional mathematics were jokingly called "black holes" for him.

At the end of the next two years together, the investigator began to realize that this student could compute higher level mathematics while he was sitting in the inclusion classroom for physics but she could never understand how he did it, nor could he tell her. Now after five years of research, it is clear that he was using the visual symbols written on the board to compute the answers but he did not understand their meaning so he could not apply or generalize the concepts. This malady is typical for children and adults with autism and learning disabilities.

During this research and study, the researcher has come to identify with this population of people who struggle with social identity and interaction. Hans Asperger "identified with them to the extent that he believed that to help autistic people one needs

to have a dash of autism oneself" (Frith, 1991, p.32). Frith (1991) concluded the first chapter in her book by writing that she, too, would sometimes like to claim a "dash of autism" because it is not a bad way to characterize the detachment and unworldliness of the scientist who is obsessed with an all-important problem and forgets all else.

Our worlds are defined by our perspectives. Our perspectives are developed through experience. The researcher brought to this study the bias of believing that we, as individuals, are as different as we are the same due to our unique individual development. It has been her attempt to understand the views of many different people during this study. From the teacher who must organize learning for typical learners to the parents who must structure individual learning experiences for their unique offspring, education is the framework by which we encourage growth and change.

It is also the researcher's bias that the purpose of education is to provide appropriate learning environments for all children. It is her sincere hope that this document provides an insider's view into the world of the child with Asperger Syndrome within his educational environment, both at home and at school. It is only through this type of comprehensive, systematic investigation that we can correctly identify and treat these children within the regular classroom appropriately.

Rationale Behind the Strategy

Bruner (1961) identified three processes in the act of learning: acquisition, transformation, and evaluation. Acquisition referred to the exposure of new information or the refinement of previous knowledge. Transformation was the process of manipulating knowledge to make it fit new tasks. It was the analyzation process which

was important in generalizing information. Finally, it was important to evaluate whether one's transformation or generalization was accurate or appropriate (Bruner, 1961). Bruner wrote that in learning any subject matter there was usually a series of episodes involving these three processes. At its best a learning episode reflected what had happened before the episode and permitted one to generalize beyond it.

Jensen (1998) speculates that while the typical brain is quite adept at learning, the amount of information criss-crossing our lives today may be a hundred or thousand-fold compared to what it was just 50 years ago. He suggests that one of the solutions to enhance meaningful learning is to ensure quality rather than quantity in teaching. In other words, teaching should focus on metacognitive integration rather than rote or surface knowledge.

This new brain-based model can be somewhat misleading with the child with Asperger Syndrome. There is a basic assumption that the typical brain belongs to a social being. According to Jensen (1998), "because we forge meaning through socializing, the whole role of student-to-student discussion is vastly underused. Talking, sharing and discussing are critical; we are biologically wired for language and communicating." (p. 93). The typical child with Asperger Syndrome is not wired for social interaction. They typically display social avoidance, social indifference, and/ or social deviance (Edelson, 2002). Individuals with AS struggle with the emotional demands of the classroom (Williams, 2001). They tend to not only be socially isolated but also demonstrate an abnormal range or type of social interaction that cannot be explained by factors such as shyness, short attention span, aggressive behavior, or lack

of experience in a given area (Szatmari, 1991).

Strategy Design

The concept attainment model constructed for models of teaching by Joyce and Weil (1996) was employed in this investigation. They explained their model in this way:

> Concept attainment requires students to figure out the attributes of a category that is already formed in another person's mind by comparing and contrasting examples (called exemplars) that contain the characteristics (called attributes) of the concept with examples that do not contain those attributes (p.164).

The data sets were built on concepts which were clearly defined and, in our case, concepts which had already been introduced to students either in the previous grade or during this school year. They were designed in a seven-seven-seven format. This design was based on a conversation with Emily Calhoun, coauthor of *The Role of Instructional Theory and Research*, who suggested that twenty exemplars are usually considered adequate to facilitate the acquisition of a concept but the presentation of seven-seven-seven had been effective in her recent collaborative work with Joyce (1996) . Each of the seven examples illustrated a particular attribute of the overall concept (see Appendix A). Students were then asked to "scrutinize" the examples, compare and contrast the functions of the positive and negative exemplars and make notes regarding what they believed the examples had in common on their answer sheets (see Appendix B).

Theoretically this would be a difficult task for the Asperger Syndrome child because he/she would not be expected to have theory of mind. Theory of mind is the

innate ability to determine another's intentions. In this case, the child would be expected to determine the attributes of a particular concept and then draw a conclusion based on those attributes.

The twenty-one examples of the particular concept were designed to allow a longer time for processing the idea for the child with Asperger Syndrome. The compare and contrast format was designed to encourage metacognitive problem solving.

The examples for the strategy were taken from the McGraw Hill Mathematics Series, Math in Our World, and the Spelling Mastery Series developed by Scientific Research Associates and were chosen by the regular classroom teacher, support teacher and the researcher. The validity of the words and concepts used in the strategy was determined by a former fifth-grade teacher, a resource teacher and a university professor who evaluated the items in terms of fifth-grade ability and within the scope of special education children in an upper elementary setting for content validity. The former fifth-grade teacher and resource teacher were selected for this validation because they were experienced in teaching children with Asperger Syndrome in the classroom.

Daily performance charts were constructed for each student recording their ability to identify the critical attributes for each step of the model. An independent evaluator was hired to monitor the videotaped classroom sessions and read the daily data charts for inter-rater reliability.

Support Strategy

Imagery and visualization were important aspects of the support strategy being used in this study. The subject was asked to create and manipulate a mental picture.

Images have been assumed to provide an effective framework for organizing materials which must be remembered or utilized by representing items as interconnected or associated (Reese, 1977). Sousa (2001a) writes that teachers spend much of their class time talking about learning and little time is given to developing visual cues. Imagery represents a major way of storing information in the brain. Sousa defines two types of imagery: (1) the visualization in the mind's eye of something already experienced or (2) the depiction of something that someone has not yet experienced.

The ability to think in pictures or use visual thinking has been expressed as a strong skill by Grandin (1995), one of the most successful and outspoken adults with autism. As Quill (1995), reports, "Although it is widely recognized that children with autism have strengths in the area of visualization, there is very little literature to show its use in therapeutic endeavors with this population" (p.288) The visualization strategy used in this study involved the use of three exemplars for each session (see Appendix C). Five exemplars illustrating the concept were placed on a board under two headings, "Yes" and "No." The items under "Yes" were exemplars of a particular concept. The items under "No" were exemplars that did not belong to the concept (see Appendix D).

To facilitate this strategy, the student was asked to close his eyes and relax. Methods for relaxation were taught before the strategy was used. These methods included but were not limited to: tensing muscles and relaxing, taking deep breaths, or leaning back in the chair and relaxing the back. The teacher required the student's full attention in a relaxed state before reading the trial exemplar. The teacher instructed the student to make a blank screen on which to visualize the problem. The student was then

asked to solve the problem and tell the teacher the reasons why he came to this conclusion. Items for this strategy had been used in an unpublished pilot study conducted by this researcher.

The success of the strategy was determined through interviews with the student. An independent evaluator was hired to type the interviews with the student and validate the conversations used in this dissertation.

Instrumentation

An informal instrument for assessment was chosen for this study for several reasons. The pretest design was teacher-made to evaluate just the spelling and math concepts being presented during the two weeks of this study. The concepts used were specific to the two programs, the McGraw Hill math series and the SRA Spelling Mastery series, being used in this classroom. The purpose of this assessment was to describe how all of the children were functioning in relationship to each other at the beginning and the end of the investigation period. A Spearman rho correlation coefficient was determined for the pretest stanines and the students' IOWA Basic Skills Test stanines from the previous year for concurrent validation.

Qualitative analysis was used to determine correct responses on the pretest, post test, and retest. A former eighth and ninth grade English teacher was hired through a local employment agency as an independent evaluator to establish inter-rater reliability.

Sampling

Before the study took place, the researcher completed the on-line course for Human Subjects Research from Montana State University. Written consent forms were

approved and the study was deemed exempt from review. The parents of the child about which the study is written signed these consent forms and were advised of their right to confidentiality. Every effort was made during the structuring of this material to protect their true identities.

The subject chosen for this study was an eleven-year-old male diagnosed with Asperger's Syndrome and ADHD by a board certified neurologist in the state where the study took place. This type of nonprobability sampling has been identified by Chein (1981) and Patton (1980) as purposive and purposeful. Merriam (1988) suggests that purposive sampling is chosen to learn the most from a particular population. Honigman (1982) supported the use of nonprobablity sampling in field work because it was only through this type of sampling research questions could be satisfactorily answered.

To obtain the sample, the researcher distributed fifty research announcements at the state's Council for Exceptional Children's conference. Two families responded to the announcement but one of the children was not enrolled in a regular classroom environment. He was being educated in a private school for children with behavioral disorders. The family of the second child was contacted by phone and the study was described to the father. A copy of the proposal was e-mailed to the family and the Daley Elementary School staff where the subject was attending fourth grade.

A conference call was arranged with the principal, special education teacher, psychologist, regular education teacher and parent. The researcher and the staff elected to do the study during the following school year so that the special education teacher

and parents could attend a conference on Asperger Syndrome which was to be held in the summer and facilitated by the researcher.

The father and the special education teacher, as well as the mother of another child with Asperger Syndrome in the district, attended the conference during the summer. The researcher was able to meet with the father and special education teacher briefly during lunch to establish a date for training. This date was ultimately changed because the father had planned to take his son hunting during that period of time.

Criteria for the sample included a diagnosis of Asperger Syndrome with a full scaled score on the Wechsler Intelligence Scale- III (WISC-III) which fell in the average to above average range. The subject also needed to have a significantly low score on the arithmetic subscale of the WISC-III and be included in a regular classroom setting.

The subject was evaluated using the Wechsler Intelligence Scale for Children III (Wechsler, 1994). This test is one of the most well known measures of intellectual ability in children. It is divided into 13 distinct subtests (information, similarities, arithmetic, vocabulary, comprehension, digit span, picture completion, coding, picture arrangement, block design, object assembly, symbol search and mazes) which yield a verbal and performance score as well as full scale intelligence quotient. The WISC-III has been reviewed in *The Thirteenth Mental Measurements Yearbook* (Impara & Plake, 1998) and is considered valid in the areas of factorial validity, convergent/divergent validity, predictive validity, differential validity/bias, and clinical validity; however, there is evidence that the WISC-III yields many false negatives. Strict application of diagnostic rules yields few false positives (i.e. few normals are identified as abnormal),

but they also yield many false negatives (i.e. most abnormals are identified as normals). Practitioners can be reasonably confident that children with "abnormal" profiles are likely to be abnormal, but many abnormal children will not show abnormal profiles. The manual summarizes studies evaluating the degree to which gifted, mentally deficient, ESL, LD, epileptic, ADD, hearing-impaired/deaf, and language/speech children show atypical WISC-III scores or patterns. Of importance to this study is that the processing speed index was not lower than other index scores in LD children (Impara & Plake, 1998).

Subtest reliabilities are moderate to excellent (.61 to .92). The consistency of IQs and Indexes is (.80 to .97). Subtest stability coefficients, based on 353 children subdivided into three age groups are adequate (.56 to .89). IQ and Index stability is moderate (.74 to .95; only one coefficient below .80). Inter-rater reliabilities for selected Verbal Scale subtests are excellent at greater than .92.

Though the WISC-III is widely used, considered valid and reliable, it is noted in a review by Jonathan Sandoval, Professor of Education, University of California, Davis, that the subcategory called Freedom from Distractibility which uses the arithmetic and digit span subtests is an unfortunate description of the skills actually measured by these subtests. He suggests that auditory-numerical attention and memory might be a better description of these subtests (Impara & Plake, 1998). For the purpose of this study, the arithmetic subtest was used as a measure of auditory-numerical attention and memory.

Developmental records obtained for the subject indicated a full scale score on the WISC-III of 93 with a verbal score of 89 and a performance score of 100. His

arithmetic subtest score of four was his lowest scaled score on the test placing him in the second percentile in relationship to other children of his age taking the test.

The Asperger Syndrome Diagnostic Scale, ASDS, (Myles, Bock, & Simpson, 2001) was also administered during the observation period with both parents. This standardized test is designed to aid in the identification of individuals ages 5 through 18 who manifest the characteristics of Asperger's Syndrome. Internal consistency of the ASDS was determined using Cronbach's coefficient alpha technique. A coefficient alpha of .83 for the Asperger Syndrome Quotient (ASQ) was determined. The ASDS is considered valid and reliable when used in conjunction with the psychiatric guidelines found in the *Diagnostic and Statistical Manual of Mental Disorders: Fourth Edition.* The subject's parents rated his ASQ at 122 which indicates a high possibility of Asperger Syndrome.

Gaining Permission to Study

The researcher and school met six weeks prior to the date set for the study. The final date was set for the first two weeks in December. This time period changed from the original three weeks suggested in the proposal to two weeks because the study needed to be done continuously and plans for the week before the Christmas break had already been made by the teacher and her colleagues in the other fifth grades.

On the day of the meeting, the researcher arrived during the last thirty minutes of school to observe the subject in the classroom. The subject worked well during a group activity but as the day drew to a close, the teacher dismissed the class and turned to assign the subject's homework which included handwriting. Immediately the child

began to whine, ran to the corner, turned his back on the teacher and curled up in a rocking position. When the teacher got him to come back to the desk, he put his hand on the desk and would not let her open the desk to find the paper. The teacher was very kind and gentle in her approach to the child. She began asking questions to determine why he did not want her to open the desk. Eventually the child let her open the desk and she explained the homework. Meanwhile, the mother and father arrived in the classroom and the child's behavior changed completely. He began talking with his father as though nothing had happened previously in the classroom.

The teacher acknowledged the researcher and shared that this type of behavior happens frequently but that the child eventually complies. Introductions were made to the mother of the child and the child before the group went to the special education teacher's room to conduct the training.

The researcher was asked to complete the training in forty-five minutes as the staff needed to leave at 4:00. The researcher opened the floor to questions. The kindergarten teacher asked, "What is Asperger Syndrome?" Briefly the researcher shared the broad characteristics of Asperger Syndrome and how these characteristics are manifested differently in each child. The training moved to a brief demonstration of the visual concept attainment model and the modification of the model which included auditory input.

An effort was made to set up a time for writing the exemplars, examples, to be used with the model, but it was determined that the exemplars would need to be written and agreed upon via e-mail over the next two-week period in order to be validated.

Ultimately, due to the illness of the teacher, these exemplars would be constructed by the researcher with input and validation from the support teacher and classroom teacher via e-mail. Three professionals which included a former fifth-grade teacher, professor, and special educator provided content validation for the exemplars before the study.

Data Collection

Data collection took place during the two weeks of study. Data were derived from a variety of methods: audiotapes and videotapes, field notes, confidential files, daily data response sheets and participant interviews.

An independent evaluator was hired through a local employment agency to view the strategies and validate the students' responses on the daily records as well as the pretest, post test, and retest documents. The evaluator was a former eighth and ninth grade English teacher. The same independent evaluator was hired to type interviews with the school personnel and parents, which were validated one month after the study by mail, and to audit all of the materials included in this dissertation. Inter-rater reliability was determined as a percentage of agreements to disagreements (Richards, Taylor, Ramasamy & Richards, 1999). Each answer was read by both the researcher and the evaluator to determine the intent of the answer. Any disagreements were discussed and reconciled before final numbers were reported in tables or in the text.

Data collection is the source of the thick rich description advocated by Lincoln and Guba (1985). Merriam (1988) points out that the use of multiple methods of data collection is a major strength of case-study research. Triangulation, the use of multiple sources to support a finding, assists the researcher in correcting biases that may occur

during the research process (Denzin, 1970; Howe, 1988; Lincoln & Guba, 1985).

Interviews were conducted with nine adults and the child with AS during the observation period. Eight of the interviews were tape recorded, transcribed, and labeled for reference. Three of the adults agreed to be interviewed but did not want their responses recorded, either electronically or in written form. Field notes served to describe these interview sessions.

The bulk of data collection came from the daily videotapes of each session in the classroom and the daily response sheets submitted by the students twice a day. The data resulted in 288 pieces of information to be analyzed for the study. Charts of daily responses were made for each student so that accurate comparisons could be made regarding the child with Asperger Syndrome and his peers. The subject and all of the children in the class were given pretests, post tests, and retests to determine relative position and to measure any differences between the different stages of instruction.

The data processing analysis for this study followed the analytic induction strategy described by Goetz and LeCompte (1981) "This strategy involves scanning the data for categories of phenomena and for relationships among such categories, developing working typologies and hypotheses upon an examination of initial cases, then modifying and refining them on the basis of subsequent cases" (Lincoln & Guba, 1985, p. 335). They state that negative instances, or phenomena that do not fit the initial function, are pursued in order to expand, adapt, or restrict the original idea.This technique has also been described as holistic analysis where a detailed description of the case emerges from the data collection. "The investigator narrates the study through

techniques such as a chronology of major events followed by an up-close or a detailed perspective about a few incidents" (Creswell, 1998, p. 63). The analysis for this study developed into three major categories which were enhanced by teacher interviews, related literature, and detailed testing information.

Participant Description

The participant selected for this study was an eleven-year-old white male living and attending school in the small, rural town of Daley in northern Colorado. (The town, names of people and schools have been given pseudonyms to honor the participants privacy and confidentiality). This non-incorporated community of approximately 901 people is located ten miles outside one of the major cities in Colorado where one of the state's universities is housed. It is primarily a bedroom community where the majority of the working population travel into the nearby city each day for employment.

There are approximately 958 children served by the school district. The elementary school houses 407 children in grades K-5. The school is located on the county line and serves children living in the next county. There are more children attending school than live in the town itself which makes the school an important gathering place for the community. School activities, athletic events and community meetings are well- attended, making the school the heart of the community.

The school complex is located off the main thoroughfare and stretches two city blocks. The primary school and high school form wings on either side of the elementary school creating a protected playground filled with swings, tires, and climbing equipment. Staff members are warm and welcoming. The subject in this study has

attended the same school since kindergarten.

RH is the only child of Tom and Margaret Heath. Mr. Heath is a retired corporate executive and until recently, because they are getting divorced, Mrs. Heath did not work outside the home. She is now working independently from her home.

The prenatal and delivery history for RH was validated during the parent interviews and from the school records. His prenatal period was uneventful except for one brief period during the second trimester when his mother was painting and exposed the fetus to fumes. Delivery was three weeks late, approximately seventeen days, and the doctor induced labor due to a failing placenta. Both parents validated the last ten minutes of birth as being difficult due to several brief unexplained heart failures during the final stages of delivery.

RH attended a special education preschool to help in the development of language skills and prepare him for first grade. Mrs. Heath confided during the home interview that she had not been trained in education and did not look for developmental milestones during his early years.

The Special Education Cooperative for the area evaluated RH using several assessment tools when he was four. RH was given the First Step Screening Test for Evaluating Preschools. His profile indicated that he was average in the cognitive domain but moderately deficient on the social-emotional subscale. The adaptive behavior profile was considered average. There was nothing to indicate that RH's development was a concern. His father indicated that his own speech had not developed until the age of four. On the Battelle Inventory his adaptive behavior was the only subtest which was

significantly below (14 months) his chronological age. The cognitive and personal-social tests were considered average. The psychologist noted that many areas of cognitive functioning were found to be in an average range, and most self-help skills appear to be age-appropriate. Language contributes heavily to thought formation, as does visual imagery. The combination of inadequate storage/retrieval mechanisms for language and weakness in the visual-motor associative process can impact negatively upon cognition. His delays, in other words, were interrelated and affected both linguistic and motoric tasks. At that time, she noted that RH's probable dysfunction in the expressive language and visual-motor areas, which were considered to be neurological, were possibly the result of birth or other risk factors.

RH's Communication Skills Progress Report in kindergarten indicated the speech-language department was working on understanding language (auditory comprehension), question formation and appropriate responses, socially appropriate communication (pragmatics) and listening comprehension which were evaluated as making satisfactory progress. The speech-language clinician also indicated that his performance was satisfactory in motivation and attendance.

At age six, RH was tested using the WISC-III (Wechsler Intelligence Scale for Children, 3rd edition). His Verbal, Performance and Full Scale scores were in the average range. According to this test, RH's scores on understanding verbal information, thinking with words, and expressing thoughts in words were in the average range. His Performance Intelligence Quotient (PIQ) score was 100 which was in the average range as well indicating his ability to think about designs, pictures, and puzzles and to solve

problems without using words was adequate. According to the psychologist, his skills in nonverbal problem solving were in the average range. The psychologist did add that his actual score on the Verbal Intelligence Quotient (VIQ) was 89 but was computed as 95 by eliminating one very low subtest, the arithmetic test. She noted on his report that the subtest was heavily dependent on verbal short-term memory, attention span, and problem solving which were necessary in school. A hand-written note explained that the VIQ was a better predictor of school success and this could improve to the Verbal Comprehension Index given better concentration and more efficient problem-solving.

Along with the WISC-III, the psychologist also administered the Burk's Behavior Rating Scales which indicated significant concern in areas of withdrawal, self-concept, coordination, personal identity, realistic interpretation of environment. Areas of very significant concern were attention span, and impulse control. The Beery Developmental Test of Visual-Motor Integration provided an age equivalent of 4-10 which would not have been a significant delay at 6-0. The psychologist did recommend that it would be beneficial for RH to be evaluated for ADHD by a physician.

An Occupational, Physical Therapy and Adaptive PE Screen was also administered during RH's kindergarten year. It was observed that he threw poorly, had difficulty catching a ball, ran with difficulty and demonstrated poor rhythm during music activities. He exhibited a poor abnormal pencil, pen and/or crayon grip using a four finger grip. At six, he made reversals of numbers and/or letters, had difficulty copying from a book, wiggled a lot, and was frequently out of his chair. This scale indicated that RH objected or refused to be touched. He preferred to touch rather than

be touched. It was noted in the margin that he was great at hidden pictures, a characteristic of autism documented in the research of Baron-Cohen (1999).

A Child Study Team meeting was held during the first grade year for RH to determine whether he had a handicapping condition. The team qualified RH under the diagnosis of speech/language impairment because his ability to use language to problem solve and follow directions is significantly below his peers (over 2 standard deviations below the norms). They referred RH for ADHD testing by a physician and designed a program which included speech, occupational therapy and written communication. A request for release of confidentiality was included in his file from a local physician a month after the meeting.

In the Child Study Team report written a year later, a medical diagnosis of ADHD was given and it was reported that RH was taking 20 milligrams of Ritalin in the morning. The mother would indicate in her interview that they (the parents) never saw much improvement on Ritalin as it had worn off by the time he returned home from school.

Throughout second grade, RH received speech and language therapy. When he entered third grade, the teacher recognized his symptoms and suggested to the parents that he be evaluated by a neurologist. His parents took him to a neurologist, who first introduced the term Asperger Syndrome to them. The doctor wrote in his report that he believed RH might be an individual who fells into the category of Asperger Syndrome. The doctor also suggested that an additional neuropsychological evaluation could result in more specific suggestions to the school in terms of interventions. He did not suggest

a follow up session to the parents.

The parents sent a letter to the school sharing the doctor's diagnosis with the school. A Child Study Team (CST) was held to change his diagnosis from Speech and Language Impaired to Other Health Impaired. At this meeting, his third grade teacher wrote that RH was bright and often eager but he was working differently due to his "physical" syndromes. He needed a lot of attention and understanding of him and of Asperger Syndrome. He needed routine, explanations of feelings and communication skills. The wait time when he answered and/or related a fact was very long. He was uncomfortable when writing or changing activities and he wanted explanations for many things. The other students and teachers needed to understand and work with the situation. He needed his horizons expanded slowly. He also needed help understanding our "typical" world.

After third grade, RH entered fourth grade where his teacher, Mr.Jones worked through his problems on a day to day basis. Mr. Jones was the only teacher who did not verify his interview for this study. He thought RH was "pretty on top of things." Mr. Jones indicated RH could be socially aggressive. If RH did not want something on his desk, he might shove it off onto another child's desk and this would result in a back and forth struggle. Mr. Jones observed that RH liked to work alone and he thought RH viewed himself as a loner as did the other children.

At the time of this study RH was in the fifth grade with Mrs. Howe, the teacher who agreed to participate in the study. She indicated in her interview that she had never had a student like RH. She though he produced different challenges for her but she

enjoyed and learned a lot from him. She, too, admitted that finding workable strategies for the subject in the classroom had to be developed and revised through working with him individually. RH and she had figured out what worked for them. She didn't know if that's what other people did but she could usually get him to do things. A lot of times she couldn't do it right there in the class. It had to be done at another time and time was always a problem.

Time would be an issue throughout this study as we tried to implement an information processing model in the classroom. Information processing takes time (Sousa, 2001a; Joyce and Weil, 1996). In this particular study, finding the time to implement this study after the plans for the fifth grade team had been written for the week created a great deal of stress for the regular classroom teacher. The time for the processing strategies would be limited to 30 minute increments in order to meet the curriculum demands.

Limitations and Delimitations

Single subject designs are limited regarding generalizing ability due to small numbers of subjects. These designs are usually limited to specific settings, situations or individuals. In the area of special education, however, or specialized groups of individuals, single subject designs may provide valuable information for educational or clinical work (Richards, Taylor, Ramasamy, and Richards, 1999).

This study was limited by its single subject and the small rural one school setting. It is also limited by one grade level and the interaction of one teacher and one support teacher with one set of parents. The strategies used in this study also limit its

findings because critical aspects of the strategies were designed specifically from the McGraw Hill math series and the SRA Spelling Mastery Series.

Many delimiting factors occurred during the study. Initially the study had been planned for three weeks and then, given the time of year, the study was shortened to two weeks. A considerable distance existed between the school and the researcher which limited contact before the study for more training and preparation. When the researcher arrived at the location, she was informed that the parents were in mediation over their pending divorce and there was a conflict regarding the welfare of the child. These mediation sessions affected the child and parents during the study.

CHAPTER 4

RESEARCH FINDINGS

"The thing I find most frustrating is...one thing is trying to do normal social things like go to a restaurant or something. It's impossible. It used to be less impossible [but] now that he is getting bigger, it's really impossible. It's just like you have to leave him somewhere." Father of the subject.

Introduction

In this study fourteen children, three receiving special education services, were presented the same new concept of learning, first visually and then orally, within the regular classroom environment. The focus of this chapter will be the effect that this presentation had on the child identified with AS in relationship to his peers.

The results of the study are presented in three sections. The first section is an in-depth chronological account of the research project taken from field notes and interviews and includes the visual/imagery method presented in isolation with the child diagnosed with AS. This section is presented in this manner to alert the reader to the reasons changes were made in the study design. The second section describes the analysis of the modified concept attainment model presented to the class. The final section summarizes the home study which includes current parental concerns and future goals for the child.

Chronological Account of the Research Project

RH lumbered into the busy fifth-grade classroom with his head down and eyes on the floor. Frith (1991) wrote that these children were "healthy and beautiful" (p. 14). RH was a good example of this description. He was slightly taller than most of the boys

in his class with a broad, open face. His flawless pale skin was accentuated by deep, dark eyes captured in a mass of dark hair. To the casual observer, his face looked angelic with a wide-eyed innocence. It is this innocence and lack of pretense or malice that often makes the child with AS a victim.

The subject put all of his books away in his desk before looking around the room. As soon as he saw the investigator, he approached her with appropriate eye contact and a smile.

"Are you the one who is trying out your theory on me?" he asked.

RH had been "primed" regarding the change in schedule for the day. Priming is a technique suggested for many children with autism and Asperger Syndrome. It involves telling the student before entering a situation that a change might occur. This warning helps prepare the student in case changes in routine cause unusual anxiety.

The rest of the students hurried into the room picking up band instruments and rushing out to the band room down the hall. RH walked quickly down the hall to the Resource Room where he usually received spelling instruction in a small group every morning for forty minutes.

The researcher met with the father for a few minutes outside in the hallway. The father confided that the parents were going through mediation proceedings and that their divorce had become complicated. A major source of disagreement between the parents was their son's school placement. The mother felt RH would be served better in a private school environment, whereas the father believed the best place for the child was in public school where he could be assimilated into society like other children. The

father hoped that the mediation session, which was to be held in three days, would not affect the study.

When the students returned to the classroom, the researcher was introduced and the pretest for the concept attainment model was presented. The rationale behind the development of this instrument was to introduce an instrument which was new to the subject and to his peers but was validated concurrently with a nationally normed test, the IOWA Basic Skills Test. Results of the pretest scores and stanines in math compared to national stanines are included in Table 1.

Table 1. Correlation of Pretest Math Stanines and IOWA Basic Skills Test Stanines

Raw Scores	z-score	Stanines	IOWA Stanines
07	-0.83	3	5
10	0.16	5	5
09	-0.16	5	5
12	0.83	7	8
11	0.66	6	6
14	1.49	8	7
*05	*-1.49	*2	*5
12	0.83	7	7
08	-0.49	4	5
03	-2.15	1	5
10	0.16	5	5
11	0.66	6	7
08	-0.49	4	5
12	0.83	7	8
07	-0.83	3	6
13	1.16	8	9

* Scores indicate subject's scores in relationship to his peers.
Correlation Coefficient .803 significant at the .01 level (2-tailed)
Inter-rater reliability computed at .95.

A Spearman's rho was also calculated for the spelling scores in relationship to the IOWA Basic Stanines which was .743 and considered significant at the .01 level (2-tailed). Scores for the pretests in these subject areas were considered valid in terms of their relationship to general achievement scores as measured by the IOWA Basic Skills Test. Inter-rater reliability for test scores was computed at .99.

The subject's score for math placed him in the second stanine in relationship to his class even though his score on the national achievement test on concepts and estimates was in the average range. His spelling score was also in the second stanine on the pretest but his score on the national achievement test for spelling was slightly below average. It should be noted here that RH's scores were not the lowest in the class, either on the teacher-made test or the national stanines.

After giving the pretest, the researcher presented the first math data set. RH sat near the front of the classroom within the reach of the teacher. During the presentation, RH stretched across his desk quietly without any discernible communication with the teacher.

The researcher walked down to the Resource Room to join RH after the presentation of the first data set. The investigator was given permission to videotape the "literature circle" being facilitated in the Resource Room but within minutes, RH became agitated and the teacher asked the researcher to stop videotaping. She told the researcher that he seemed upset even though outwardly RH seemed more disengaged. He was watching the researcher and not the teacher. At this point, the researcher asked if interviewing RH would help the situation. The support teacher agreed.

In this taped session, the researcher was trying to establish rapport with the student as well as provide a baseline for the reader regarding language structure and thought process. During this interview, several typical problems in communication become apparent as well as some insight into his thought processes.

Investigator (I): Do you have trouble solving problems?
RH: Sometimes.
I: Can you give me an example?
RH: Take this morning.
I: What happened this morning?
RH: The other side of the pretest sheet.
I: What was hard about that one?
RH: What was the question again?
I: Was it on the auditory or the visual side?
RH: I don't know what auditory is.
I: It's listening.
RH: Oh.
I: Was it the one you were listening to?
RH: The second problem on the sheet on the side that didn't have my name on it.
I: Ok, the side that didn't have your name on it; so, it was the auditory side.
RH: And that was the problem.
I: Oh, that was the one with the exponent.
RH: No, no, no, no, no. Not that. . .the problem was the name. I like to write my whole name and you made me write my initials.

The researcher would find that RH did not turn in his pretest with the other students. He hid the test in his desk where the researcher would find it the next morning. Because children with AS are often confused and cannot structure an appropriate question, they may elect to avoid a situation entirely.

RH also shared this exchange with the researcher regarding self-insight:

RH: You know, I'm kind of different from other people.
I: Oh, how are you different?
RH: I'm always hungry and I kind of have this itching problem.(He was referring to the 15 warts on his right hand which were dry and itchy).

I: What do you do when you're always hungry?
RH: Eat.
I: You can't eat all the time.
RH: Yeah, I've got to breathe, too.

Throughout this study, RH would indicate that he had a heightened sensitivity to smell, taste, and touch as well as difficulty regulating certain feelings such as coldness and emotions such as disappointment. After RH was dismissed from the Resource Room, the researcher reviewed and copied the psychological, academic, and education records which had been collected on the subject since pre-school. RH had been identified for special services initially because his communication skills were poor.

An initial interview with the Resource Room teacher revealed that RH had difficulties with anything out of the routine. This was the first year that Mrs. Brown, the Resource Room teacher, had worked with RH; in fact, it was only her second year as a teacher. She thought his biggest problems involved "not knowing what to do when he gets frustrated; not knowing how to ask for help; and not knowing how to help himself." Mrs. Brown shared that RH would cry if he was upset. "I see it if he can't spell a word. I'll say, 'Just spell it.' He'll say, 'I can't, I need to spell it right.'" Throughout the study, RH struggled with spelling and usually resorted to writing symbols rather than words.

Another area of concern for Mrs. Brown was that RH rarely asked questions. Rather than ask a question, RH would shut down and do nothing. "We're trying to get him to say, 'I need help.' Otherwise, he will stop and we'll look over and realize that he's not doing anything." This tendency is mentioned by Attwood (1998), and he recommends, "Should the child be reluctant to seek help by raising their hand and

thereby feeling stupid or possibly being ridiculed by the other children, then a secret code can be arranged between child and teacher"(p. 120). Teachers may fail to remember that the classroom is a social situation where children with AS fail to understand the social rules. Myles and Southwick (1999) note, "Nonverbal communication deficits and related social context communication problems are common among persons with Asperger Syndrome"(p.13). The social environment may be overwhelming to the child with AS.

After lunch, the teacher, Mrs. Howe, completed the first data set of spelling using the concept attainment model with the students in the classroom. The researcher interviewed RH following the lesson to obtain further information about the model. During this conversation it became clear that RH was confusing the grammatical rule with the spelling rule. One other student had this problem in class. The researcher worked with RH to structure the rule through modeling.

I: Can you say, when you have...
RH: When you have...
I: What kind of word?
RH: Pop? (RH responded to the visual cue)
I: When you have a three or four letter word...
RH: When you have a three or four letter word...
I: That ends in...
RH: That ends in....
I: What?
RH: CVC
I: When you have a three or four letter word that ends in consonant-vowel-consonant . . .
RH: Or *is* a consonant-vowel-consonant. (He remembered this from the discussion)
I: And you are going to add what kind of ending?
RH: You are going to add. . .what kind?
I: An "ed" or "en."

RH: An ed or an en. *Or* you are going to change the vowel.
I: Wait, we're not going to change the vowel, though. If we are going to add an "ed" or "en," what are we usually going to do?
RH: Talk about or draw a past tense.
I: We're not going to...
RH: We're not going to?
I: RH, you are thinking about the meaning and what I'm talking about is what you do, the spelling rule.
RH: Oh.
I: When you have a three or four letter word that ends in a consonant-vowel-consonant, and you're adding an ending "ed" or "en," you're usually going to do what to the consonant?
RH: Double it.
I: You are usually going to double it. That is the rule.

This type of explanation would require too much time in the classroom setting, but it is valuable information for the support teacher who may be frustrated with the child with AS who is not starting an exercise. If the AS child is confused about the concept, he may be unable to a structure the question to ascertain the needed information. This session also indicates the need for this child to have more one-on-one instruction so that

any misconceptions about an idea can be discussed or taught again.

At the end of the school day, the father visited with the teacher about RH's work and joined the researcher in the library where RH put on a spontaneous puppet show about three little pigs. Despite claims that AS children tend to be reclusive (Williams, 2001), RH was able to reach out into the environment on this occasion to share his sense of humor and enjoyment of pretend play which he shared with his father. Developmentally, however, this type of play would be seen in a much younger child. Children with AS may seek the attention of adults rather than peers to "play" in this

manner. Adults may provide more language connections and patience than typically developing children.

At 8:00 the next morning, the researcher met with Mrs. Howe, the classroom teacher, to discuss any changes that needed to be made in the model and to give her feedback about the students' responses. When RH arrived, the researcher followed him to the Resource Room where they began the visual/imagery method training.

The Resource Room is a busy place at Daley Elementary School where children come in and out whenever they need assistance from Mrs. Brown, the support teacher. This morning the small classroom was filled with five students working on different projects when the researcher and RH arrived. Mrs. Brown led them to a small office space across the hall where the classified staff checked in each morning. There were two chairs and a small table facing the left side of the room. The time clock, refrigerator, and staff mailboxes also occupied the room. Throughout the "training" session, classified staff came in and out of the area to clock in and put their lunches in the refrigerator.

During the first early morning session, the researcher elected to go over the concept attainment model in a one-on-one situation with RH because his teacher was not sure that he was familiar with all of the terms used in the SRA Spelling Mastery Series. The researcher and RH used information from their previous discussions to fill in the concept attainment answer sheet. The previous day's concept attainment model, data set #1 in spelling, was used in this exercise to facilitate instruction. The researcher also brought Oompas, a fruit treat and reinforcer, for the subject. RH's comment the

day before about being hungry coupled with his lack of compliance on the writing portion of the test prompted the investigator to explore the subject's need for tangible reinforcement. The subject responded well to the instruction and the reinforcer.

At this point, it was time for RH to return to the classroom. He and the researcher walked back to the classroom setting to present math data set #2 to the entire class. After the math presentation, RH went to the library with his class and returned thirty minutes later to work on handwriting in the classroom. At recess, RH walked the perimeter of the playground which he does every day. As recess was finishing, RH approached the investigator who was sitting alone on the swings observing.

RH: Do you want to come with me?
I: Sure.
RH: I sing when I swing. (RH is talking to the researcher over his shoulder as he strides three steps ahead of her).
I: Can I record you singing?
RH: Sure.

RH's singing was not captured on the tape, but it was an original song. After the bell rang, RH asked if the investigator would come out again at lunch. When she told him that she was already interviewing his teacher, he said, "Oh," and abruptly ran ahead.

Teacher Interview

Mrs. Howe was a veteran teacher with eight years experience. Her classroom was extremely well-organized with colorful student-made projects lining the walls and covering the bulletin board. Throughout the videotaped observations in this

classroom, Mrs. Howe maintained a professional demeanor.

When asked if the child with AS produced any challenges for her in the classroom, Mrs. Howe indicated her biggest frustration was not being able to predict the child's behavior or understand his motivations.

> Like when you have a task for him. Is he going to have a stress fit? Is he going to refuse? Is he going to do it? You know, his reaction is. . . he usually takes more explanation. You know, you'll say, "Get out your science notebook, everybody." He just sits there. You know, there's always something of a reaction of his, either not doing it or, "Why are you asking me?"

When the researcher asked what the subject did during a stress fit, Mrs. Howe shared that he usually got a high-pitched voice. "When he gets frustrated, he starts chewing on his hands and he gets anxious, you know? I'd say, 'RH, stop. It's OK. What part of that don't you understand?'" RH's response to this question was sometimes, "I don't know what my science book is." The use of the word, "what," rather than "where" is an example of the structural problems leading to confusion in the classroom. Mrs. Howe continued her example by saying that she would say, "It's this one right here. I need you to get that out because that's where your notes are." Sometimes RH would comply and sometimes he would not. She went on to say, "and then he doesn't do it, or he still won't do it. I don't know how to get around that. And then I say, 'Would you mind if I get it out of your desk for you?' I don't know what else to do."

Mrs. Howe had not received additional training for working with children with Asperger Syndrome. She had been invited to the conference on Asperger Syndrome in the summer but had been unable to attend due to prior commitments. The bell rang and

the students in Mrs. Howe's fifth grade settled down to complete spelling data set #2.

The following day brought the first heavy snow day of the season to the little town of Daley. Of the children observed, all came into the building wearing coats, boots, and mittens. RH had on a short-sleeved blue T-shirt and tennis shoes. The children came into the fifth-grade classroom with more chaos than usual, so Mrs. Howe sent them back outside to come in quietly.

The researcher and RH walked down to the little cubicle where they would be working on visual/imagery. This room might not be considered ideal circumstances to teach a visual imagery strategy based on oral directions; however, this is typical of the rural school environment where every available space is used for education. The investigator began this session by reminding RH of the classroom tape he had viewed with his father the previous evening.

> I: Today we are going to work on a new strategy. We're going to be doing something called visual imagery. Last night when we looked at the tape and we saw you in the classroom, do you think you were paying attention in class?
> RH: Not very much.
> I: How did you know?
> RH: I was (hunches over the desk).
> I: You were hunched over the desk?
> RH: That's usually what I do when I am looking. I was kind of (leans over the table) looking.

It is interesting to note that RH seemed to equate paying attention with looking and not listening. The researcher went on to ask more questions about listening but gets very little response.

> I: Do you feel like you listen really well in class, RH; are you able to do the things that your teacher asks you to do?

RH: Sometimes.
I: Sometimes? Well, I think sometimes you do pay attention in class but sometimes I think you have trouble in class. Would you agree with that?
RH: Maybe.
I: When someone is talking, do you ever make pictures in your mind? Have you ever done that?
RH: Kind of. Pictures on the camera?
I: Do you want to try that today?
RH: Maybe.

In analyzing this conversation, very little communication was happening between the researcher and the student. RH did not understand what paying attention meant nor did he have the experience of visualizing. He was, however, willing to risk this interaction with the researcher which again demonstrates the innocence of this population which, without supervision and proper social skills training, can result in victimization.

I: Ok, I need you to lean back in your chair, and put your feet on the floor. Are you more comfortable with your arms crossed like this?
RH: Yes.
I: Ok, and do you feel comfortable closing your eyes?
RH: No, because then I can't see what I got to do.
I: Ok, well, you don't have to do anything other than listen.
RH: Ok. (RH practices closing his eyes.)
I: Is that ok with you?
RH: Not really.
I: You don't feel comfortable closing your eyes?
(RH doesn't answer).
I: If I closed the door, would that help you a little bit?
RH: Maybe.
I: Alright. (Researcher leaves the door slightly cracked).
Now, do you feel more comfortable?
RH: (no answer)
I: If you close your eyes, can you make a blank screen in your mind?
RH: No. Well, I can if I'm sleeping.
I: Let's see if you can do it now. Just close your eyes and I'm going to describe something to you.

RH is closing his eyes, when he says excitedly: Hey, I got a thing already!
I: Alright, what is it?
RH: I got two naked blue trolls looking confused behind jail bars and they are exactly the...they look exactly the same way, they're twins!
I: They're twins, huh?
RH: The only difference about them is one has a feather on the right side of their head and the other one has a red feather on the other side.
I: I noticed that your eyes are not closed. Can you close your eyes?
RH: They are closed!
I: You think they are? Ok, face the camera right there so we know that your eyes are closed. Then I want you to make a blank screen because I am going to put some information in and see if you can do that, ok? So, make a blank screen. Can you make a blank screen?
RH: Maybe if I can get this part...the picture I have already out, I will.
I: Ok, I'm going to give you a word problem, RH, and I want you to make the picture in your mind. I'm going to say that Mrs. Brown has five students in her class. Two of them have to go back to class. How many remain?
RH: Three.
I: What was the picture that you made in your mind?
RH: Mrs. Brown was a big square in a big room with a door and two little squares which were the students left and the three students all lined up in a row with ropes behind them which made them look like the letter, three.(He meant number.)
I: Oh, I see. Do you want to try another one?
RH: Sure!
I: You did a great job with that one.
RH: By the way, I just wanted to say that math in my best subject.
I: I can see that. I can see that you did that very well. Ok, well, Sara brought her camera to school. She took 10 pictures. She gave Mrs. Howe four of them, then she gave RH two of them, how many pictures, did Sara....?
RH: Four!
I: How did you do it, RH?
RH: I made a rainbow line of ten pictures and then I took four of them (like cards) and then I took away four of the cards and placed them on the table and then the other person took them. Then that person left and I came in and sat down and two cards were removed from the deck and I got the two cards and set off and I all I saw left were four cards.
I: Those four cards represent what?
RH: Pictures!
I: They represent pictures that who made?
RH: Shelby.
I: Shelby or Sara?
RH: Sara. I kind of have this problem remembering names.

I: Do you? You are doing great. What do you think of this? Is this fun making pictures in your mind?
RH: Maybe.

Mathematical Processing and Learning Styles

These unusual thought processes were documented by Asperger in one of his original case studies, Harro I., where he described what he called autistic originality in mathematics. He observed that even though Harro I. could calculate numbers correctly and quickly, his methods were too complicated. Asperger wrote, "Here we come to an important insight; in autism there is a particular difficulty in mechanical learning, indeed there is an inability to learn from adults in conventional ways. Instead the autistic individual needs to create everything out of his own thought and experience. More often than not this results in defective performance, even in the more able autistic individual." (Frith, 1991, p. 56) Asperger's observations were influenced by the theories of thinking and learning in 1944.

Mathematics, according to the authors of the National Council of Teachers of Mathematics (NCTM), makes more sense and is easier to remember when students find connections with existing knowledge. (NCTM, 1998). They recommend teachers should provide experiences and opportunities necessary to apply math skills in the classroom in order to make learners responsible for making sense of mathematics. Asperger's insights into the mathematical thinking of children with AS may have been more general in that these children did not learn from the same social environment or presentation style as their peers.

Sousa (2001b) suggests that students are more likely to be successful if teachers use instructional strategies that are compatible with their given cognitive styles. Determining learning styles for individual students is not a new concept in education; however, when this researcher interviewed the two current teachers and parents involved with the subject of this study, there was no conclusive agreement among them regarding how RH learned. The following are transcriptions of the interviews with parents and teachers regarding how RH learned concepts:

> Mom
> MH: I don't know what you mean by concepts. Did he learn from experience? I don't think he learned by experience or by his mistakes. . .He didn't learn orally. Now, I think it has to be made important to him.
>
> Dad
> TH: I'm not sure what you mean . . .this is what I think you mean. . .how did RH pick up information about abstract concepts before the study?
> I: Yes.
> TH: I assumed he did it the way I do, through observation, analysis and applying it to the world through experimentation. I get it by reading or having someone explain it to me and then I internalize it and match it with my experiences.
>
> Mrs. Brown
> I: Before this study started, how did you think the child with AS learned concepts?
> MB: I think he had a hard time or he wasn't going to get it. I think he had a hard time learning new concepts.
> I: How do you think he got them, though, before [the study]?
> MB: Probably by watching others.
> I: He watched other people do a certain thing but you weren't...
> MB: (She laughs) I don't know.
> I: That's a fair answer.
>
> Mrs. Howe
> I: Before the study, how did you think RH achieved concepts?
> MH: High, average, low? What are you looking for or just in general?
> I: In general.

MH: In general. . .it depended on what subject. It depends on what it is. I mean if its something he's interested in. . .animals. Our first unit was vertebrates and invertebrates. Achieved that a lot better. Basically depends on his interest peaks.
I: Ok, how did you think you got information over to him?
MH: Spending mostly one-on-one time with him. Teaching a class lesson sometimes.

Refining the Visualization Process

During the visual/imagery exercise, RH was totally engaged in the process. Frequently, he would physically move as he was telling the story as in the example with the cards. He physically moved to place the cards on the table. RH was quickly able to remember the facts even though the setting was unusual. In the following portion of the lesson, the researcher attempted to help the subject create more realistic images.

I: Let's see if we can make our pictures more accurate. Can you get a picture of Sara in your mind? (Sara was used in this example because she was a student RH knew).
RH: No.
I: You can't get a picture of Sara?
RH: Not yet, and oh, by the way, I'm only good at cartoon forms. It takes a while to, how do you say, make them real. . .(waits a minute and says) well, I guess I'll have to do them in cartoon form.
I: Have you done this before?
RH: No.
I: Ok, then, how do you know that it takes a long time for them to become real?
RH: Do you mean trying to do it with my eyes closed when you are doing it or with my eyes open?
I: So, sometimes when you're doing it, your eyes are open?
RH: Uhhum, but not all the time.
I: Ok, so let's do one idea. I know that you are good at recalling things. That is why I like to do the math things with you. Let's do one more thing and see if you can make the pictures in your mind. (RH is yawning here; perhaps, the first time that the investigator has seen him relaxed). Sara was out on the playground playing with two friends. Four more friends decided to join them. Sara had to go inside. How many friends were left outside?
RH: Six.

I: How did you do it?
RH: Well, I imagined Sara with two other friends and well, four friends came and that made seven but when she had to come in, that left six.
I: What are you doing in these word problems? What kind of . . .what would you call it?
RH: Using my mind.
I: Ok, you are using your mind. If I drew a picture, or if I asked you on this piece of paper (researcher draws a picture of the concept attainment model, using the yes/no format). If you had to choose an example of what you just did, which one would you choose? (See Appendix C)
RH: The "no" side.
I: Why the no side?
RH: I don't know . . .

He had selected the correct example of the concept but he was still unsure why it was the correct answer. It might have been good to introduce the terms one-step problem solving and two-step problem solving in this session but the researcher was attempting to establish a baseline response for auditory processing and concept attainment. We would continue working on this technique the following day.

On the morning of the third day, researcher presented math data set #3 to the class. At 9:30, students got out their math boards and Mrs. Howe taught them the distributive property. Mrs. Howe moved back and forth between students to check their answers and give one-on-one help. After instructions had been given, students began working on their assignments. It took RH two minutes to begin working. He was quiet and appeared to be on task but very little was written on his paper. Another student also struggled to begin the assignment and eventually RH had more accomplished than this student.

At recess, the researcher filmed RH walking the perimeter of the playground.

His routine involved walking straight from the building in a marching fashion to the far end of the playground and then marching around the swings and back up toward the building.His father joined the researcher unexpectedly while she captured his son on camera. There was a heavy snow falling as RH marched around the playground in his short-sleeved T-shirt rubbing his arms and talking to himself.

> Dad: I think that is a sort of a hereditary thing, too, because I'm a lot less sensitive to cold than other people. I had the experience in Alaska of hunting with a friend and he fell in a creek and got all wet and he was like freezing to death and so I changed clothes with him and I was ok wearing his wet clothes and walking back while he was freezing to death.

Mrs. Howe's fifth grade returned to class after recess to complete their math assignments. Students were asked to put their papers away at 10:10 so that everyone could walk to the computer lab which was located in a small mobile unit attached to the building. Throughout this lesson, RH needed one-on-one assistance from the parent, a fellow student, or the teacher. At 11:30, students went to the gymnasium where they were engaged in playing 3-on-3. The teacher shared that RH usually did not play team sports so he was shooting alone at a basket on the other side of the gym. Another student was also playing alone. This was the same student who struggled with the classroom assignment earlier in the day.

When the class was over, RH was the last person off the floor. He was gasping for breath as he ran to the door. The teacher announced that RH had broken his own record that day. He made 46 points playing his own game. Several students gave him a high five and RH asked the investigator if she would tell his father.

The researcher invited the class to have lunch with her in the classroom. The

purpose of the interview was to get feedback from the students regarding the concept attainment model. The children shared that the hardest data sets involved math. One girl commented, "It's hard to word everything into the thing. It's hard to word it." Another girl stated, "It's hard putting "morphographs and stuff." There was a comment that the spelling was easy. The researcher asked what made spelling easy. The children said that they "knew" the spelling. When the researcher probed deeper on this subject, the children said that it was hard to put the math into words. One boy added that the spelling was already in words and easier to explain. After thinking for a moment, he clarified his thinking by saying, "Math is not as easy because we do more spelling." RH joined the group but did not speak to anyone and was the first the leave to go outside for recess.

As the researcher was cleaning up the room for Mrs. Howe, RH looked into the classroom window from the playground. He took snow from the ground and smeared it on the window. Two younger girls came out of the building and reprimanded him, "RH, don't do that! It's a teacher's window!" RH immediately dropped the snow and asked, "Can I pick it up off the ground?" One of the girls, probably in second or third grade, answered, "Yes, you can pick it up off the ground but you can't throw it." She walked away looking back over her shoulder to check on RH. RH looked around, turned, and began walking the perimeter again rubbing his arms and talking to himself.

RH and his father arrived at school in a calm manner on the fourth day sharing with the investigator that the visual schedule that she had helped them create at home

was working. A visual schedule is a list of activities or pictures placed on the student's doorway or in the kitchen on the refrigerator to help the person self-monitor his/her daily activities. The father reported that RH was able to complete most of his morning routine without any prompting.

The investigator and RH collected their materials for visual/imagery and hurried down to their office space. This session was intended to be used for gathering baseline data for the visual/imagery model described in the methodology section of this document.

> I: So, are you ready? I'd like to see if you are ready by if [sic] having you sit up in your chair, and you're relaxed and did it help you to listen yesterday by closing your eyes?
> RH: Umhum.
> I: It did? Can you do that? RH, sit up, please.
> RH: But I usually write, eat, like this. (leans over the table)
> I: But you don't have to write right now, all you have to do is listen. So, do you want to close your eyes and make the blank screen so you can make a picture of this word problem?
> RH: Umhum.
> I: Are you ready? (Researcher checks for relaxation). Regina worked 27 hours, Louis worked 6 hours. How many more hours did Gina work than Louis?
> RH: How many hours did Gina work?
> I: 27. Can you get a picture of what's happening?
> RH: 21.
> I: Ok, so write down your answer.
> RH: On back?
> I: Right here. And why? How did you do it?
> RH: I don't like to write reasons.
> I: I know but all you have to do is write the problem. What did you do? What did you do to get the problem?
> RH: Well, Lisa, or Regina and the other person, I forgot if it was his or was it her name? Anyway, Louis left six hours later and Regina left 21 hours after he left.
> I: What picture did you make in your mind?
> RH: They were both sitting at desks in rooms. One behind Regina and the other guy was there. Anyway, the pretend hours were seconds. Six

hours later, he left. Seven hours later, she left. But after he left, she had to wait another 21 minutes.
I: 21 hours, you mean?
RH: Yes.
I: Now look at our concept attainment board, where do you think the problem you just did would fit?
(RH points to the side of the board which showed subtraction.)
I: It would fit on the "yes" side, why, what did you do?
RH: I subtracted?
I: Excellent. Would you please write that down? Would you write down what you subtracted?
RH: On the second one?
I: On your reasons, because that is the reason you got your answer, RH.
RH: What am I supposed to write again?
I: Let's go back and think, we look at our concept attainment board, we know that it fit on this side. So, what did you do to get your answer?
RH: I subtracted.
I: You could either just write down, "I subtracted," or you could write down the subtraction problem.
RH wrote the problem 27-6=21.

At this point in the process, the tape ran out and the researcher had to place a new tape in the recorder. The researcher asked RH to try to make a blank screen and put the numbers of the problem in that blank screen.

I: Are you relaxed? Are you ready to listen? Regina worked 20 hours, Louis worked 6 hours, and Dan worked 3 hours more than Louis. How many hours did they work in all?
RH: 35. (The answer was achieved in less than 5 seconds).
I: How did you do it?
RH: Well, if 3 more than 6 is 9 and 9 is 6 and one minus 6 plus 5....
I: Can you tell me the story back?
RH: Well, they were all sitting at the table working on a project from something. Six hours later, one of them left, and three hours after that another one left and after 20 hours they started, the third one left.
I: So, how would you write that as a math problem? Let's look at our concept attainment model here and say, which side would it belong on?
RH: The "no" side.
I: The "no" side, how would you write that?
RH writes 20 + 6 + 9 =

Our time would be up for this session. Some decisions would have to be made about the visual/imagery model format for RH. Initially, the visual/imagery method was designed to reduce and/or focus RH's auditory processing time. RH's auditory processing time was excellent in isolation and providing a contrast/comparison model appeared to be helpful in framing his answers, but they did not help him in describing his process. Next week in the classroom, the data set examples would only be presented orally. It was uncertain at this point how RH would react to this presentation.

Mrs. Howe presented the math data set #4 to the class. RH and several other students went to the Resource Room to do their reading assignment. When other students went to recess, RH had to work on spelling homework which had not been completed. He was asked how many minutes he thought it would take him to complete the assignment. Five minutes was determined to be adequate time and the visual timer was set. Even with the visual timer, RH had trouble staying on task. If he was interrupted for any reason, he had trouble refocusing his attention.

The investigator had made arrangements to interview Mrs. Bale, RH's third-grade teacher, at lunch. Mrs. Bale was the first person in the district to recognize RH's neurological deficits. She suggested that his parents take him to a neurologist for an evaluation. After reading the information about Asperger Syndrome, she worked with RH and his class to understand his disability. Mrs. Bale purchased books and sent them with RH's records to his next teacher. This teacher expressed to the researcher her frustration in getting information about the syndrome passed along to the next teacher.

In her interview, she posited, "How do you explain the problem of communication when they are quiet and sit at the back of the class?"

The researcher returned to the fifth-grade classroom where spelling data set #4 was presented. This was an early release day for the elementary school, so Mrs. Howe delivered a short Language Arts and Social Studies lesson. RH was off task fifty percent of the observation time.

The researcher checked in with the teacher before leaving today about how the study was progressing. Mrs. Howe stated honestly that she had not anticipated that so much time would be used to implement the study. She was feeling pressured to keep up with the curriculum requirements as well as participate in the study. When the investigator asked what could be done, they developed a streamlined presentation with one-word examples in a different design. Mrs. Howe also expressed her need to keep the presentation time down to thirty minutes. While planning for the next week, she would carve out thirty minutes after lunch to do the data sets consecutively.

The next morning Mrs. Howe asked that the models be presented back-to-back after lunch in order to allow her to catch up on curriculum work with the students. The researcher met with the father in the library to discuss how to proceed with the study. At this point, many issues were delimiting the research project (i.e., the parents were in the middle of mediation, teachers were concerned about the time involved in the study, and there was a general confusion about the concept attainment model itself). It was decided that a meeting would be held in the classroom at noon to discuss possible

directions. The researcher called the university research team for advice and was prepared to report their suggestions at the 12:00 meeting.

The researcher called the university and a member of the doctoral committee. He indicated that the school and the researcher would have to decide the best way to proceed. He suggested documenting any changes which needed to be made in the study.

The teacher, parent, and support teacher met in the classroom at noon and the investigator asked for permission to tape the meeting. This meeting captured many of the concerns shared by the parent and professionals who work with children with neurological disabilities. Early in the discussion it was decided that the study should continue but on a limited basis, only thirty minutes a day, after lunch. The father tried to arrange a meeting so that issues regarding the findings of the study can be shared. The following is an excerpt from the discussion in which three definite positions emerged in the process: the classroom teacher's needs, the parent's needs, and the support teacher's needs.

> I: Ok. [To the father] So, you're wanting to call an IEP meeting. Is there a time when we can do that? (IEP means Individual Educational Plan)
> Dad: I was wondering if, while you're here and since you're offering to help us figure out a better plan for what we could be doing with RH, if we could have an IEP meeting next week sometime.
> I: We don't even have to call it an IEP meeting, because that's not what it would be. What it's going to be is me sharing what I've observed over the last ten days. And I would suggest maybe we do it Wednesday? Would that be better to do since that's the day before the Christmas program, or . .
> Mrs. H: Yeah. Can we do a meeting like that . . . Could we . . . Is there a time when I don't have kids or have someone watch my class so it's not another thing that I have to go to for this?
> MB: Yeah. What I would like to do is . . .rather than put it all in writing like the

researcher said . . .is what I would like to do is I would like to hear her suggestions, and then I would like to process them, and then we'll do the IEP. Then we'll have time to think about it.
Dad: Ok. The main concern I had is that if we need to get Liz or anybody else . . (Liz is the psychologist for the district).
MB: We do.
Dad: We could talk about it today so we could try and schedule it.
MB: But I would like to just share this information she has, and I would like to process it myself.
Mrs. H: Before you write any goals for it.
MB: Before I write anything down in permanent ink, I would like to process . . .I would like the time to process it.
Mrs. H: A brainstorming session that you lead because of all your studies in the best ways to help.
I: Ok.
MB: That's what I would like.
Dad: Ok, so the four of us and Margaret and who? The principal?
MB: I think definitely the principal should be there.
I: Ok. Right. Well, let's just go ahead and plan that. Who's going to be in charge?
MB: Of setting up the meeting? I guess I will be.
I: Ok. I'll have everything ready. When are we going to try to do it?
MB: Next week--while you're here.
Dad: Sounds fine with me.
MB: Mrs. Howe, do you want like 2:15 for twenty-five minutes? . . . Will that be enough time? (Looks at investigator).
I: Yes.
MB: I can't speak for the principal that has to be tentative.
I: Oh, sure. . . . That's fine. I'm available. I'm available to do it any time you want.
MB: Ok. And then is it all right with you if we just talk about things and then in another month discuss . . ?
Dad: Yes.
Mrs. H: Tuesday or Wednesday?
MB: Ok, either one? . . . But I would just like to kind of process information before I write anything . . .

Spelling and math data sets #5 were presented at 1:00 after the students came back from lunch. The researcher left the research site for the weekend.

The second week of the study began with a visit to the principal's office early

on Monday morning. The father made an attempt to set up the meeting we had discussed on Friday with the principal. The principal was reluctant to set up a meeting and requested to see the researcher.

Mr. Venton was a polite and professional administrator. His concern for the welfare of the school was clear. He reported the teachers felt they were being evaluated rather than the student. According to Mr. Venton, they felt they were doing things wrong. As a staff, they had decided not to have a meeting. They would appreciate the researcher writing a report and giving suggestions, but the school would make any decisions necessary regarding the adoption of any changes. The researcher agreed with the school's decision and reassured the principal that the school had never been the object of the study; however, being in the classroom had always been an integral aspect of the project. She offered again to withdraw from the study, but the principal encouraged her to stay and complete the project with these changes.

The researcher met with RH in the library to work on the visual/imagery method and talk about how it could be implemented in the classroom when the concept attainment model was being presented. RH shared that the oral presentation was confusing to him. The researcher suggested that they try to "rehearse" using the visual/imagery model when the teacher was giving the presentation. The following is an excerpt from that session:

> I: Let's do that for just a second, can you put your feet on the floor and your back against the chair? Now, you can either close your eyes or you don't have to close your eyes but can you make the blank screen that we talked about before and I am going to say these numbers and see if you can make them. Twenty, five-tenths, thirty-six, two-hundredths, forty-nine, three-

hundredths. Can you make those pictures?
RH: Yes.
I: Yes? You can?
RH: Did you say, can you make pictures or those pictures?
I: Those pictures.
RH: Oh.
I: When I say numbers, can you remember numbers in a row?
RH: (shakes head)
I: No? You shook your head. What does that mean?
RH: I don't know.
I: On your blank screen, can you make the numbers?
RH: No.
I: Not very well? Ok. What would help you with this, RH?
RH: I don't know. Maybe. . .will this be over?
I: After I leave today?
RH: When your week is done?

RH was confused and the researcher switched strategies to see if focusing on the abstract model would help RH connect with the visualization strategy.

I: So, if you looked at these (Pointing to the abstract circle and squares), instead of closing your eyes and trying to imagine, could you see like, for example if I said, "100." Could you put that on this dot?
RH: Yes. It would be the middle zero. There would be a one beside it and a zero beside it.
I: Ok, what if I said, "200?"
RH: Yes. A two, zero.
I: But what if I said, "236?"
RH: I'd be stuck.
I: Could you remember 236 by looking at this, RH?
RH: Yes.
RH is momentarily distracted by the light on the tape recorder.
I: So, RH, can you do that? Can you imagine this here (pointing to the circle)?
RH: No.
I: Ok.
RH: I mean, yes. Points to the circle, "Two, three and a curved line over it."
I: Ok, let's see if we can do that with words. If I say, "Bag, can you make that here?"
RH: Yes, you could make a "b" and "a" and a "g" with a line in it.
I: Ok, today, when Mrs. Howe does this with you, I would like for you to try to see the numbers and the words on each of these symbols.
RH: Ok.

I: What will happen then? Will you be able to remember better or not?
RH: Maybe.

At this point, the researcher decides to write a social story with RH. A Social Story is a technique developed by Carol Gray (1995), a consultant to children on the autism spectrum, which involves writing out a problem, determining the child's perspective, and developing a plan of action.

I: (Researcher begins drawing a social story). You are sitting in class and Mrs. Howe is talking. What are you doing?
RH: Hmmmm. Thinking about the movie that I want to see with my Dad. (RH draws a picture of the movie in his thought bubble).
I: I think you are right, RH.
RH: Monsters, Inc. (The name of the movie).
I: When Mrs. Howe is talking, you are thinking about Monsters, Inc.
RH: and more. . .
I: What should you be thinking about?
RH: I don't know.
I: What do you think other children are thinking about?
RH: The problem?
I: Why aren't you thinking about the problem?
RH: Please no more pictures!
I: Do you think maybe other people are thinking about a movie?
RH: Monsters, Inc.?
I: If everyone else is thinking about the problem, what should you be thinking about?
RH: The problem.
I: Let's draw a picture of you thinking about the problem. Should this always be true? When someone is talking? What do you think?
RH draws a sad face on the picture of himself.
I: Why are you frowning?
RH: I'm not frowning.
I: You're not frowning?
RH: The question mark shows that I'm kind of upset and I don't and . . . confused.
I: So, when someone is talking, when your teacher is talking, you are kind of upset and confused? How could you change that, RH? What could you do when you feel upset or confused?
RH: Think about the problem.
I: Do you think that will help you?
RH: Uhhuh.

The researcher suggests to RH that he could raise his hand and ask for help if he was confused but that would be unlikely in this social arena. Teachers may find it helpful to rely on the support teacher or classroom aide to serve as an interpreter for the child with AS. Reflections on the visual/imagery method revised the format of the strategy for the researcher. If this strategy were to be used with other children, the following format might be helpful:

- Determine if the child can make visual images on the blank screen.
- Describe the concepts illustrated on the concept attainment model.
- Help the child into a state of relaxed alertness.
- Read a grade appropriate word problem to the student.
- Solicit the answer to the problem.
- Ask the student to identify the attributes of the oral word problem by looking at the concept attainment model.
- Ask the student to describe "why" the oral word problem would fit the concept attainment model.
- Give feedback regarding the student's description.

The researcher shared RH's possible difficulty with the handwriting with Mrs. Howe. It was agreed that for the final two days, answers would be provided to students to determine if the handwriting was the major problem in achieving the concept. The researcher would share typed answers with Mrs. Howe in the morning.

When the researcher arrived the next day, Mrs. Howe met with her at lunch to look over the written answers for the concept model and to express her concerns that when the investigator's study was completed, the parent would push for a change in the subject's program. The reason for her concern was an e-mail that the father had sent the previous evening. In the e-mail, the father expressed his realization that RH was not generalizing spelling concepts. Given the limited responses recorded on the various

concept attainment exercises, it was unknown why the father suddenly recognized that his son had simply been memorizing the spelling list week after week without integrating the concept. The following is an excerpt from the e-mail.

> Tonight RH and I were just studying RH's spelling list for this week. I gave him the test verbally until he could get them all right. On the second try he was down to two words he was having trouble with. I started jumping around and coming back to the two words (which were #5 disaster and #13 transfer). I jumped to number 15 and sounded out "commitment." He then asked me "Is that #1 (which is communicate) or number 15 which is commitment? I had not been telling him any numbers but I was giving him the words mostly in order. When I told him #15 he spelled commitment correctly. I then asked him to spell word number 1 with out telling him the word and he spelled communicate correctly. Yet when I say the words out of order he is not sure which is which. It boggles my mind that he is apparently learning to spell the words to some degree more by where they fall in the numbered sequence then by phonetics or the whatever other people use."

The father went on to describe his own difficulties with spelling as a child and as an adult. Mrs. Howe perceived these reflections as the father recognizing that things needed to be changed within his child's program to accommodate RH's needs.

This would be the last day that the class would work on the concept attainment model. Mrs. Howe and the researcher discussed trying the visual stimulus and the visual answer today since RH had been the only person to miss the concept the previous day in math. We were determined to see which presentation would result in every child achieving the concept.

Summary of the Chronological Account of the Study

This study was strongly influenced by several factors: (1) the limited amount of teacher training, (2) the limited time and resources to conduct the research, and (3) the distance between the researcher and the research site.

The qualitative format of the study allowed the researcher and the teacher to make changes within the study which changed the focus of the study in order to accommodate the demands of time in the classroom. The researcher, the teacher, the parent, and the support teacher had different assumptions regarding the time and focus of the study. Though the researcher went to the research site, trained the staff, and followed up with the e-mail development, the teacher did not feel confident during the research implementation. It has been noted in the literature that the "micropolitics" of personal relations, the cultures and resources of research units and universities, the powers and policies of government research departments, and even the state itself crucially influence the design, implementation, and outcomes of research" (Punch, 1986). Researchers' fields of investigation are often limited by those who control the research settings (Burgess, 1982). Given the circumstances, the study provided many learning experiences for everyone involved in the study.

Addressing the educational needs of students with mild disabilities appropriately in general education classrooms is a challenge (Fisher, Schumaker, and Deshler, 1995). This problem is exacerbated by the lack of training teachers receive regarding exceptional populations (Deshler & Schmaker, 1988). In their explanation of the strategies integration approach for general classrooms, the authors note that strategies instruction usually requires additional classroom instructional time. "In many cases this requirement limits students' opportunities to learn to apply strategies to curricular content" (Desher & Schmaker, 1988, p. 15). Even though the support teacher in this

study had received some instruction regarding children with AS at the summer conference, formal training of this teacher and the regular classroom teacher needed more time.

Johnson and Sloat (1980) noted that training effects might be more illusory than real because few teachers maintain training effects without support. Peer coaching is advocated to maintain training effects. "Continuous practice is essential to enable even highly motivated persons to bring additions to their repertories under effective control" (Joyce & Weil, 1996, p. 380).

This research had been funded partially by scholarship money from Delta Kappa Gamma International. The cost of housing, training materials, and transportation limited the time and availability of the researcher to stay and implement the study for a longer time. The time of the year, the two weeks before Christmas break, were orchestrated around the needs of the teacher, students, and researcher based on the curriculum of public school and the university system rather than the best time for the implementation of a new strategy or concept.

The distance between the researcher and the research site, almost 220 miles, as well as the commitments of the researcher prohibited several visits to the research site to gather baseline observations of the research site, establish an adequate comfortable relationship, and provide adequate training.

Future studies regarding the teaching of new strategies might allow between nine and twelve weeks to implement the study in the classroom. This would require the researcher to be located near the research site so that frequent visits to the school could take place before, during and after the study.

A larger number of teachers might be involved in the study to ensure that strategy and assessment instruments are valid. A minimum of two hours could be given to the initial training of teachers implementing the study in the classroom. Teachers need to feel comfortable and confident in their ability to implement anything new in their classrooms. Though the teacher in this situation was aware that this investigation was primarily focused on the child with Asperger Syndrome, her anxiety concerning the time needed to implement this model in the classroom impacted this study.

The focus of this investigation was only one child within the school environment, however, the presence of the researcher within the classroom and the participation of the other students in this study required a more complex plan for change. Future researchers may call a meeting of the parents of the children in the classroom to discuss any concerns prior to the study. Even though the researcher's openly invited parents to call her if they had any concerns, none of the parents involved in the study made contact with the researcher prior to the beginning of the study. Closer proximity to the site might have provided more opportunities for parental involvement.

Analysis of the Data Sets

Initially the data sets were analyzed using two criteria: (1) did the student state an idea for the concept which was similar to the concept for which the presentation had been designed and (2) how did students describe their thinking process. After the second day when the research project needed to be streamlined to accommodate for time, it was determined that the "process" portion of the response could be determined by the attributes which were identified in their answers. If they were discussed in class, this would cut down on the processing time; therefore, the processing portion was not evaluated after the first two days. It also became clear after the first two days of the study that RH wrote fewer words than the other students in the class. The researcher began to collect data on the number of words or symbols the students used to express their ideas of the concepts.

The items for the first math data set are listed in Appendix A. In the first step, the teacher and researcher were looking for answers that indicated that students noticed multiplying by a multiple of 10 would result in an answer that would end in zero. In step two, they were to notice that multiplying by a multiple of 100 would result in at least two zeros in their answers, and in step three, we wanted them to indicate that multiplying by a multiple of 1000 would yield an answer with three zeros in the product. These were concepts which had been introduced in the fourth and fifth grades, according to the classroom teacher.

The scores of two of the original sixteen children participating in the study were eliminated from the results because they had two or more absences which influenced the

class scores. On this first attempt, seven students or 50%, were recorded as noticing that the multiplication of the zeros had something to do with the answer. Four students were able to verbalize their thought processes in this first attempt. Some of the answers included:

> "Every number is multiplied by a multiple of 10 on the 'yes' side, then the numbers were given another zero, and finally the multiples of 100 got another zero." (In this case, he meant the third set of numbers became thousands)
>
> "In the first column, there are zeros in the second row and all of the answers have zero, then you changed and are multiplying by 100's and getting a four digit answer, and then your x's by 1000's and it's coming out with a five digit answer."
>
> RH wrote on his paper "All 0 at the end."

The spelling data set (Appendix E) was a representation of the "doubling rule." The students in this class had been instructed in identifying the doubling rule but this exercise indicated few actually knew the meaning behind the rule. Students were looking for answers that included ideas such as when you have a word that ends in a consonant-vowel-consonant (CVC) or is a CVC, you double the consonant before adding an ending.

Sixty-four percent of the students, eight, were able to express the concept as the doubling rule, but none of the students used the CVC pattern as the reason behind the rule. At the end of each lesson, the process was discussed and the rule was written on the board so that students received feedback about their decisions.

It was brought to the researcher's attention later that RH usually did not participate in the same spelling program as the other students in the class. This could

explain his confusion about this data set.

The second math and spelling data sets presented can be found in Appendix F. For the math data set, students were asked to identify the concepts in multiplying decimals. Students were looking for answers that included multiplying by 1 and keeping the decimal the same, multiplying by 10 requires moving the decimal over one space, and multiplying by 100 requires moving the decimal over two spaces to the right. Fifty percent of the students identified this concept, RH was one of them. Compared to the answers of his peers, RH's answers were limited; however, he was able to recognize the concept even though he did not write the process. Some of the responses included:

> Any number x's by 1 stays the same. There is a zero after the 1 and in the answer the decimal moved a space. There are 2 zeros after the one and the decimal was moved twice.
>
> The numbers are all decimals x's by 1 and have decimals. They all have the same answer. The numbers are all timed by ten. When you times a number with a d. (Decimal), the . (decimal) is moved back as many 0's there are. All the numbers are x's by 100 and have zeros so the . (decimal) moves back 2 spaces.
>
> RH: Add decimals. Number behind decimal gos [sic] up. Number behind decimal go's up two times.

The average number of words written to describe this data set was 30. RH wrote 14 words, the lowest number in the group, with no attempt to write the process. All of the other children attempted to write a processing response, but one of the other students who had been identified for special services only wrote, "I don't know." The students explained their processes in different ways. A complete list of the processes

described by the students is shown in Table 2.

The spelling data set focused on the doubling rule again when adding the endings "ed,"" ing," and "er." Seventy-eight percent of the students were able to identify the concepts. RH was not one of the students who was able to express the concept for this exercise. Student responses included the following:

> The rule is when it is a short word and ends in CVC, you double your word if there's a vowel in the next morphograph. When you add ing, you have to double it if it is a short word and ends with CVC. When you add er it's the same as above but your [sic] adding er to the end.
>
> The words that have the last letter doubled when ed is added. Words that double the last letter when ing is added. Words that double the last letter when the ing and ed are added.
>
> In relationship to his peers, RH wrote, "duble 2 letter end, 3 letter end and 2 and 3 letter end." Literally, this concept is correct but does not go beyond the visual pattern in the word.

The students continued to struggle with using the CVC pattern to describe the reason behind doubling the final consonant. This would be the last day for data collection regarding the processes. A chart listing all of the students' responses describing their processes is found in Table 2. RH was the only student who did not ever record any processes.

Table 2. Process responses.

Spelling Data Set 1	Spelling Data Set 2	Math Data Set 1	Math Data Set 2
Because it is a pattern. Same. Same	Because it looks like it. Same. Same.	Because they have one zero. Because they have two zeros. Because they have three zeros.	In the other colom, there wasen't a "." in it. In the colom it doesn't have a "." in it. Don't know.
Absent	(No response)	(No response)	Number you has two zeros.
The yes words all use the dubbeling rule. I dont know? The yes words all use the dobbeling rule.	When its a short word ends CVC and the next morphagraph beggns with a value then your first words last letter gets dobbled. The no side didn't have the dobbling rule but did have the "ing" part. The no didn't have ing, ed, or the dobbling rule.	because all the answers end with a zero. they a end with 2 zeros. the 2nd number has three 0 so you add them to the answer.	When you x's a number by 1 your answer would be the same as what 1 was xsed by. When you times a # with a.D. (a decimal) and is xed by something with a 0 the "." is moved back as many 0's there are. The "." is moved back 2 spots is because theres 2 0.
Because each word has a doubled letter. I said that because the e's are being droped.	The letters are doulbled. There using ing. Because there using ing, er, ed.	(No response)	I said that because the numbers have decimals. I saw the 10 in the "yes" colume. It is 100 instead of 10.
Because it is the doubling rule. The same reason. The same thing.	(No response)	(No response)	When you x's a demil number you usuyly get a decimal number. When you add 0 to the problem it makes it bigger because you have to move the decimal. When you add two 0 the problem get bigger because you have to move the decimal.
All of the words have the doubling word applying to them. The same reason. The same thing.	All of the last letters are doubled with ed at the end. All the last letters are doubled with ing at the end. Alle the last letters are doubled with ing, ed, or er.	All the second numbers in the sentence have a zero after them. You just added another zero to make the number bigger. You keep changing the zeros.	In the yes colum there all decimal. There all 10 x a decimal and some whole numbers. All of them are whole numbers
Each letter is doubled in the word. Same as last time. Same.	The words are doubled but used to be short CVC words.There is ing at the end of the word instead of ed. There ar doubled words with ed and ing.	Because all the numbers in the second and third colum have zeros. It is now double zeros. The number now have three zeros.	Any Number x by 1 stays the same. There is a zero after the 1 and in the answer the decimal moved a space. There are 2 zeros after the one and the decimal has moved twice.
Because the ones that arn't your idea dont have doubling letters. Some of the No's have 5 letters. The other one doesn't have 3 after each word.	Each word does not have the dobling rule. They don't in the "no" have rym. These only have 4 or 5.	Because ones that aren't your idea don't have 0's. Because they all have two zeros. I don't know.	You do not have decimals in the no column. You don't in the know column. You did not in the "no" column.

Because I can see the patern. I can see the patern. I can see the patern.	I can see the patern. I can see the patern. Because you add er.	Because they are all multiplication facts. Because I can see it change. Don't know.	I don't know. I did not put I don't know. I don't know.
It says all of someting some one could do. Don't know. It sows the way the tenpiche is.	It sows it and is just like the last one. Its sows it. It sows it upon the bord.	because the yes sid it has 1,2,5,4 hundred with a number with a 0 on the end. It has 7 x 300 and it has a loat of 0ros. iis 7 x 1000 with the ansor.	The side in the yes colon has a "." the ather side doesn't. It sous it. ith 100 now
because all the words under yes all youse the dobbling ruel. I don't know. I don't know.	because all the words are dobbled. There was ed on the end of the first words and now there isn't. There was ing in the last one.	because all of the 2 numbers end in 1 0. You added 1 more 0 on. You cept on adding 1 more 0 every time.	There are no hole numbers in the 2 digits. There are no decmals in the answer. I don't know.
So you know how to spelling the next word. I don't know. To make anothe [sic] word.	So it makes more since. Don't know. Don't know.	Because that is what it look like. I don't know. More 0	That is what it is x's by. To get the number. Some you can get the next number
because when you add you morph. You double your letters. Because first you had a 3 letter word now you have a 4 letter word and the same as the #1 reason. Because there are a few 4 and 3 letters words. And you are still only adding er.	The rule is when it is a short word and ends in CVC you double your word when theres a vowel to the next morphgraphed. When you add ing you have to double it if it is a short word and ends in CVC. When you add er it's the same as above but your adding er to the end.	because the second column has zero zero's in the sentance exept for a few in the anwsers. Because you can tell just by looking at the second column that you are only multiplying by 10's and getting variesest of #'s.	In the first column you have the same number that is in your 2nd number that you x's and the second has all kinds of different x's of ones and no decimals. You changed your = because you are x by 10 so you'll need to make your # bigger because your x by a larger number. When you multiply by 100's you x the basic fact and then add two 0's.
Thare are pot-potter the "t" in pot gets dubbled when the mortsgraph-er the e in er also enforses the dubble rule. Same as before still same as before	it added an extra letter. "Ing" insted of "ed" "er insted of "ing"	I forgot. It just didn't change. It still dident change.	Thare is a 10 insted of a 1. Thare is a 100 insted of a 10.
The No side has non doubling words. The No side has non doubling words. The no side has words that don't double.	The No side does not double the last letter. The No side does not double the last letter. The No side adds "s" to the end.	Every number is multiplied by a multiple of 10 on the yes side. The numbers were given another 0. The multiples of 100 got another space.	The no collum shows non decimal numbers. The no side just adds a 0 to the non decimal number. The no side shows non decimal numbers.

The third math and spelling data sets are found in Appendix G. The concept in math involved multiplying one digit, two digit, and three digit numbers with a decimal in the tenths place by a whole number resulting in one decimal point in the answer. Noneof the students noticed that there was only one decimal place in every answer.

Most of the students focused on the one-digit, two-digit, and three-digit numbers before the decimal including RH who wrote, "decumuls, over one number before decumul, and over two numbers before decumuls." While the answers were correct regarding the "yes" column, the students did not contrast the information in the "no" column.

The spelling data set for the day focused on the spelling rule of dropping the "e" and adding the endings "ing" and "ed." Sixty-four percent of the students were able to identify this concept. RH noticed that these words were not using the CVC pattern we had discussed earlier. He wrote, "word not duble." For the second section of the data set, he noted, "'e' stass." The investigator interpreted that to mean, the "e" stays. Several other children struggled with this idea writing that the "d" was added to words that ended in "e." This was an important misconception of the rule which Mrs. Howe shared with the class the following day.

Math and spelling data sets #4 are listed in Appendix H. The math data set involved the concept of exponents and multiplying the same number repeatedly. Any answer which explained the process of multiplying the number by itself was accepted. Fifty-seven percent of the students explained their processes in that manner. The following are a few of the responses:

If you x's a number by itself there [sic] called exponents.

You x's the number by itself as many times as the exponent tells you.

RH wrote: "No +; x same numbers; Doing =."

The spelling data set involved ways of adding an ending to words ending in "y." Students needed to recognize that words in the first section changed the word ending in "y" to "i" before adding the ending "es." In the second section, the words ending in "y" were also changed to "i" before adding the ending "ed." The final section required the students to notice that when adding "ing" to words ending in "y" no change was made. Ninety-three percent of the students recognized this concept. This was a remarkable exercise because despite this complicated explanation, most of the students were able to express it very well. The following are examples of their responses:

> When a word ends with a consonant + y, you change the y to i when you add es or ed but not when you add ing.
>
> RH wrote: y to i = es; y to i + ed or ed; and keep y + ing.
>
> Change the y to i whin [sic] (you) hav [sic] ing, er, ed and some others but don't change when adding ing.

All three of these responses came from students who were receiving special education services. This concept had been deeply integrated at this point for most students.

Math data set #5, found in Appendix I, involved the use of exponents again. Mrs. Howe had suggested making the font larger on the overhead examples. This data set focused again on the meaning of exponents. Acceptable answers would have included: the exponent means to multiply the number two times, the exponent means to multiply the number three times, and the exponent means to multiply the number four or five times. Students wrote:

> 2 numbers tymes themselfs = the number ^{2}. 3 numbers x themselfs = that number^{3}. 4 or 5 number x themself = themself $^{4 \text{ or } 5}$

> Your [sic] using a single number times its self [sic] once. You used one single number times its self 3 times. You used one single number times its self [sic] more than 3 times.

RH wrote: Use number^{2}. 5^{3}. 6^{4} or 5^{5}.

Spelling data set #5 also found in Appendix I focused on different ways of adding he ending, "ed." Students needed to identify just adding the "ed" to words, dropping the "e" to add "ed," and changing the "y" to "i" to add the ending, "ed." Seventy-one of the students were able to recognize and articulate this concept. Some students wrote the following answers to express their ideas:

> You added "ed." You dropped the "e" and added "ed." Changed the y to i and added "ed." Your [sic] adding "ed" in all of the coloms. [sic]

> Using two morphograph[s] a word and "ed." You[r] using the drop the "e" rule and using "ed" on the end. The "y" to "i" rule and you[r] adding "ed" to the end. Adding "ed."

> RH was able to identify the three parts of the answer but did not write the final concept. He wrote: "+ ed, -e + ed or -e on ed and + d = (hope + ed), and y to i + ed)."

The oral math and spelling data sets #6, which are located in Appendix J, were revised to include the seven-seven-seven format of the previous week. The answer sheet found in Appendix P was designed to streamline the writing process in hopes of reducing the time needed to complete the data sets. The abstract visual cue which was developed to avoid the use of the poker chips for visual reminders is found in Appendix U. The focus of the exercise was to identify whole numbers with one, two and three digits. Seventy-one percent of the students were able to identify that the numbers in the

"yes" column were whole numbers. There was a brief discussion regarding the properties of whole numbers. Examples of answers included the following:

> You[r] idea is whole numbers between 1 and 999.
>
> Whole numbers that get bigger.
>
> RH wrote: 1's, not tasun, no th.

The spelling data set #6 required the recognition of three letter CVC words, four letter CVC words, and a combination of three or four letter CVC words. Fifty percent of the students identified the concept. Only one student tried to find some pattern in the meanings of the words rather than the structure of them. She wrote:

> Things people know how to do or ways they look. Things you can see. Things peopl[e] can see and do.
>
> RH again wrote, "?"

The students who identified the concept wrote:

> 3 letter CVC words, 4 letter words that end in CVC, 4 letter or 3 letter words that end in CVC, and short words that end in CVC.
>
> Short words, meaning 3 or 4 letters, ending in consonant-vowel-consonant meaning the doubling rule can be applied.

Math and spelling data sets #7 are listed in Appendix K. The concept for the math data set was a simple idea set in a complicated setting. The concept was basically when multiplying factors times multiples of 10, multiply the factor times one and add the number of zeros. On the pretest, fourteen of the sixteen children recognized the concept and could demonstrate it but they did not recognize it in this oral setting. Fifty-four percent of the students were able to recognize the attributes of the concept and pull

it together as a concept. RH was not one of those students. He wrote, "100= s go firth; xs go last;1 up." Students who recognized the concept wrote:

> A number that xs by 10 and each time the number go[es] up. Every time its adding a zero to the end of the number.
>
> Numbers x by 10 turn out just adding another 0.

The spelling data set involved changing the "y" to "i" and adding es, er, and ed. Sixty-four percent of the students were able to identify this concept. Some of the answers included:

> Adding "es" to the word, same except you used "ed" on the end, same except you[r] adding "er." Changing the "y" to "i."
>
> There [sic] all ending in "ies," there [sic] all ending in "ied," there [sic] all have "ier" at the end. Change the "y" to "i."
>
> RH wrote, "No idea. Same here. + er."

Despite this incorrect answer, RH was communicating with the researcher which was a positive sign. This was not the question mark that had been seen the previous day but an indication that he was attending and did not have an idea about the concept.

Math and spelling data sets #8 are located in Appendix L. The written choices provided are located in Appendices Q and R. For the math data set, students were expected to identify that in the first section, numbers were squared or were equal to numbers squared. In the second section, numbers were cubed and in the final section numbers were multiplied to the fourth, fifth, and/or sixth power. The overall concept was exponents. Ninety-two percent of the students identified all of concepts using the

oral presentation. RH was the only person who did not identify the final concept correctly.

The spelling data set required the students to recognize that the doubling rule requires a root word which follows the CVC pattern. Only seventy-one percent of the students were able to look at the word and determine why the doubling rule was used. RH was one of those students using the oral presentation.

The math and spelling data sets for the ninth day are found in Appendix M. The answers are in Appendices S and T. The math data set involved multiplying a number with a decimal in the tenths, hundredths, and thousandths place by 10 and moving the decimal over one place to the right in the answer. One hundred percent of the students were able to identify the concept when presented with the visual stimulus and the visual answer.

The spelling data set required students to identify different ways of adding "ing" to words. They needed to identify words which just add "ing," words which drop the "e" and add "ing," and words that have the CVC pattern and add "ing." Seventy-one percent of the students identified the concept in this exercise. Two of the three students who did not identify the concept were students enrolled in special education classes. RH was able to identify all of the attributes and the concept with a visual presentation and the visual answers.

The final day of the study was reserved for the post test in the classroom. A retest was given to check retention of the concepts four weeks after the study had ended.

Results of the pretest, post test, and retest are listed in Table 3.

Table 3. Math and Spelling Pretests, Post Tests, and Retests.

Spelling Pretest	Spelling Post Test	Spelling Retest	Math Pretest	Math Post Test	Math Retest
08	10	11	07	08	09
11	11	10	09	11	12
10	10	11	12	14	11
11	11	11	11	12	12
09	11	11	13	12	08
06*	11*	10*	05*	12*	09*
10	10	11	12	14	12
11	10	09	08	09	08
09	08	11	03	07	08
07	11	06	11	14	11
08	06	10	08	08	11
05	10	10	07	09	12
11	11	11	13	15	12

*RH's scores

An inter-rater reliability score of .94 was computed for all pretest, post test, and retest responses. When the retest was given, one student was no longer in the class. Even though these figures indicate that RH made sustained growth in spelling and math, it is important to note that RH did not write any explanations on the pretest; therefore, the growth indicated on the post test and retest may be related to a better understanding of the expectation for the test rather than the strategy. RH's limited answers revealed difficulty in expressing conceptual thoughts and limited understanding of the concepts

with the exception of "y" to "i" rule; however, the other children in the class also had difficulty with the concepts. Percentages for concepts attained for the class are listed in Table 4. RH's scores indicate whether he did or did not express the concept in relationship to the rest of the class for each data set presented.

Table 4. Percentages for Daily Spelling and Math Charts.

Subject	#1	#2	#3	#4	#5	#6	#7	#8	#9
Math	50%	50%	0%	57%	57%	71%	54%	92%	100%
RH Math	No	Yes	No	No	No	No	No	No	Yes
Spelling	64%	78%	64%	93%	71%	50%	64%	71%	71%
RH Spelling	No	No	No	Yes	Yes	No	No	Yes	Yes
	Visual					Oral		Oral/ Answers	Visual/ Answers

The overall percentage of attainment of concepts for the visual math presentation was 43%. RH's scores were included in these percentages. The spelling percentage was 74% for visual presentation. Sixty-three percent of the students identified the concepts for the oral presentation of math and 57% percent of them identified the concept for the oral presentation of spelling. Even when given the choice of answers in the last two days of presentation, only 71% of the students were able to choose the critical attributes of the concept in spelling. The best presentation was the visual presentation with visual answers in math.

Students received one point for the overall concept attained for each subject area. In comparison with his peers, RH's scores which are indicated with an "*" were low on daily response sheets. Results of comparative scores are listed in Table 5.

Table 5. Comparative Scores for Spelling and Math

Spelling	2	3	4*	6	6	6	7	7	7	7	7	8	9	9
Math	2	2	2*	4	5	5	5	5	6	6	6	7	7	8

The child who scored lowest on concept attainment had been identified for special services as Learning Disabled. RH's scores, while not the lowest, were impacted by his limited ability to communicate his thoughts on paper.

Summary of Strategy Analysis

Data collected were not sufficient to determine any effect between the visual or oral presentations of the model. RH responded best when given a visual presentation and the visual answers. This was true of his peers as well. RH's performance may have been influenced by the following factors: (1) limited generation of words and (2) poor attention.

In the area of spelling, RH only generated an average of 10 words per sheet in comparison with his peers who averaged 26 words. In math, he averaged only 9 words per data set versus 28 words written by his peers.

In a follow-up neuro-behavioral visit, it was determined that even on Ritalin, RH missed 39% of target stimuli presented in a 14 minute period. This lack of attention is associated with Attention Deficit with Hyperactivity Disorder. It was also determined that RH's ability to engage in abstract concept formation and logical analysis was borderline normal despite intact intelligence. It would be impossible to determine the impact of the classroom strategy given the level of inattention RH was presenting at the time of the investigation.

Home Study

The parent interviews fell into three main categories: developmental history, current concerns, and goals for the future. RH was the first and only child of his mother, Margaret, and the fourth child of his father, Tom. Margaret's pregnancy had been uneventful, but RH's birth had been traumatic because his heart stopped thirty or forty seconds during each contraction for the last fifteen minutes of his delivery.

Both parents remembered that RH could identify the alphabet before two years of age. He also read before going to kindergarten through memorization. On the Asperger Syndrome Diagnostic Scale (ASDS), the parents agreed that the onset of unusual behaviors began around 2 or 3 years of age and that the behavior occurred in all settings.

Tom and Margaret concluded that the greatest deficits for RH were in the cognitive and sensorimotor areas. They were concerned that he seemed to lack common sense and organizational skills. Even though he appeared to have average intelligence with restricted areas of superiority, they felt RH functioned best when doing familiar and repeated tasks. He learned best when pictures or written words were present.

They noted that he was clumsy and uncoordinated. He often reacted inappropriately to smells, loud noises, and textures. RH struggled with handwriting and other tasks that required fine motor skills. He preferred certain clothes and often pulled his collar up around his neck to the extent that all of his collars are pulled out of shape.

Tom and Margaret did not see any signs of depression or suicidal tendencies in their child. They did note that he exhibited antisocial behavior; he attempted to impose very narrow interests, routines, or structures on others; he did not change his behavior to match the situation or environments; and he displayed behaviors that were immature and similar to those of a much younger child.

Socially, RH had trouble understanding social cues and did not understand the rules governing social behavior. He had a limited interest in what other people said or what they found interesting. RH had trouble relating to other people and preferred the company of adults to other children.

In the area of communication, RH spoke like an adult but often gave the impression that he knew more than he actually did. RH often did not understand subtle jokes and interpreted conversations literally. He had a peculiar voice quality and often talked excessively about his favorite topic which was cartoons.

Parental Concerns

Both parents expressed the concern that they felt helpless in getting RH to do anything independently. Tom said in his interview, "I mean on meals . . .We've pretty much given up. We have a meal. We sit down to eat and, as you can see tonight, he stands up and walks around the house and eats." Margaret shared that if she would say, "'RH, go make up your bed.' He would go into his room and start playing." They had difficulty finding and keeping strategies that would help RH become independent.

Future Goals for the Child

There was a significant difference in the ages of RH's parents. Margaret was

almost twenty-four years younger than her husband. Margaret's goals for RH centered around her concern that eventually she would be RH's only parent. She said, "When he turns 18 and says goodbye and walks out the door, am I going to say, 'Wow, I've done everything for this boy that I possibly could.'? You know, I want to do everything that I can [with]in my means to make sure that he will be ok."

Tom's concerns for RH were more immediate. He expressed, "The thing I find most frustrating is. . .One thing is trying to do normal social things like go to a restaurant or something. It's impossible. " Despite giving them the diagnosis, the neurologist left the decision to contact a neuro-behaviorist up to the parents who did not recognize the importance of getting support help two years earlier. Their approach had been to accept RH's behaviors instead of treating them.

The parents also elected to keep RH on his original dose of Ritalin instead of seeking additional or different medication to help RH remain on task and engaged with them at home. At one point, Margaret shared that recently she did give RH a dose of Ritalin during the weekend, "I gave him some in the morning and we went into Daley and it was the most normal. . .I felt so good to be with him because it wasn't that, I don't know, there is a certain feeling around him when he gets jumpy or hyper. I mean that I could speak to him and have a conversation that was normal and not about cartoon network."

Both parents wanted to know and understand what was best for their son. They were willing and eager to get additional information from a neuro-behaviorist in the area after they became aware that Asperger Syndrome could be treated through

behavioral and educational interventions.

Summary

RH's functional abilities in the classroom were different from the profile of his academic standardized tests which indicated that he was performing in the average to the slightly below average range. Compared to his peers, RH's written language ability was low. Whether this was poor understanding of the concept or the inability to express himself in words is unknown at this time. A characteristic of AS is a difference in written language compared to verbal language. Further research is needed to determine the reason for his poor written language skills.

The subject's parents were interested and willing to get additional help for their child outside the school environment. They had been uncertain how and to what extent they needed to proceed. Their response had been to accept their child instead of seeking medical, educational, and psychological treatment. They were unprepared to meet the demands of suddenly becoming a case manager for their child.

It is uncertain, at this time, who is responsible for advising parents regarding the appropriate treatment of their child if he/she is suspected of having AS. An interdisciplinary team approach which includes medical (psychiatric), educational, and psychological professionals may provide the best overall treatment program.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine how the relationship between the oral and/or visual presentation of a modified concept attainment affected the child profiled with Asperger Syndrome. The conclusions reached in this study are discussed in four sections: (1) conclusions reached about the concept attainment model in the classroom, (2) conclusions reached about the individualized visual/imagery strategy, (3) conclusions derived from follow-up interviews regarding the strategies and study, and (4) recommendations based on conclusions the researcher drew from the study.

Concept Attainment Model

All aspects of the modified concept attainment model designed for this research project were unable to be implemented for several reasons. More time at the research site was needed before the study. There was a limited amount of time for training. The distance between the researcher and the research site was considerable. The researcher and the school had a limited amount of time during which the project could be completed. The teacher was unprepared for the amount of time she considered to be necessary to implement the strategy. The researcher had not been told that the parents' divorce was not final and that they were in mediation over the welfare of the child. Despite attending the summer conference on Asperger Syndrome, few strategies suggested during the conference had been implemented at the research site or at home for the child.

Given the limited amount of data collection time and the changes in the research design, there was no effect found between the presentation of the model in a visual or oral manner. The child with AS and his peers performed better when information was presented orally with written responses from which to choose the correct answer and best when the information was presented visually with written choices. The subject generated fifty percent fewer words than his peers on daily probes completed in the classroom setting.

Information gathered after the study by a neuro-behaviorist indicated that the subject was only able to attend to target stimuli 39% of a 14-minute observation period on the drug, Ritalin, which had been prescribed for impulsive behavior and inattention. This information would indicate that the child was unlikely to attend to presentations given in the classroom 61% of the time. This factor could have influenced the outcome of the study.

Individualized Visual/Imagery Strategy

The visual/imagery strategy was also only moderately successful with this particular student. The strategy was designed to help students with AS reduce auditory processing time when given an oral math problem but this student's auditory processing was excellent. The method did help him, with prompting, to organize his thoughts more coherently. Further research in teaching concept attainment in isolation and the classroom is needed.

Given the lack of time to fully develop the individualized visual/imagery

method, the conclusions regarding this strategy are inconclusive. In a follow-up interview with the child, he was unable to create the mental images in the classroom that he had practiced in isolation. His poor attention ability while on Ritalin, which was discovered after the study, might indicate one reason for his inability to attend to the model in the classroom. RH's own description, through the use of the Social Story written with the researcher, indicated his own awareness of his inattention while the teacher was talking.

Using this strategy, RH was totally engaged in the activity unlike his behavior in the classroom. RH's ability to move from his first visual descriptions of people as symbols to more accurate and simple descriptions may provide a venue for language advancement. Suggestions for improving the strategy implementation are given in Chapter Four.

Follow-up Interviews

Follow up evaluations were completed by the father and two teachers. They indicated that the use of Social Stories and visual strategies shared by the researcher had proven effective with the subject. The father indicated continued success with the visual schedule designed by the researcher and the support teacher had developed several social stories, one which enabled the student to recognize how slowly he was writing which increased his independence and decreased his homework requirements. The regular classroom teacher noted that whenever she used visual drawings to explain concepts in the classroom, RH understood them better.

The regular classroom teacher and father indicated that RH was performing

better in the regular classroom. The support teacher felt he was performing better at times. The support teacher was rarely in the classroom setting so she did not have an opportunity to observe RH's performance on a daily basis.

The regular classroom teacher and the father thought that RH was paying attention better in the classroom with the use of visual strategies. The surveys were sent out before there was a change in RH's medication. The support teacher wrote that she thought he was not paying attention better. Again, the support teacher was not in the classroom on a daily basis so her comments were based on observations made in the Resource Room.

All of the respondents indicated that they were unsure how or if the modified concept attainment model helped the child in the classroom. The support teacher had used the concept attainment model in the Resource Room during the research study with reported positive results. These results were not recorded in the findings because the example she used was the one illustrated in the training manual. It was uncertain if RH had been exposed to this example before the research project. The father had shared the manual with RH which included the example used by the teacher in the Resource Room. When the concept attainment model was discussed with the support teacher, she indicated that she had been using the model with other students as well as RH but that he was the only student who had responded favorably.

The father admitted that his information was "second hand" but RH's grades had improved last quarter, and they were having fewer conflicts at home because RH was becoming more independent. According to the father, the reduction of homework had

reduced the stress level at home.

Recommendations

Given the limited amount of time for this study, it is recommended that further research be conducted regarding the impact of visual and oral presentation in regular classroom settings for children identified with AS. While field study provides a myriad of confounding variables for the researcher, it also provides the environment for developing theory and implementing strategies. A study determining to what extent teachers use visual versus oral presentation and at what levels would be helpful for the development of future strategies.

This study was limited by its single subject design, rural setting and the teachers in one school. A study designed across settings and subjects would provide additional and more reliable information. The attainment of concepts is central to all levels in the field of education. Further investigation into instructional theory, strategy instruction, and children with disabilities, specifically those with developmental and social disabilities, is needed.

The visual/imagery strategy attempted in this study revealed increased engagement and auditory attention in a one-on-one setting for the subject. Further investigation regarding these areas as well as refinement or increase in language development using visual/imagery strategies would be beneficial. The subject used in this study was eleven years old and at a critical time for the development of higher level thinking skills. Further research in the areas of visual/imagery for younger children might provide useful information for developmental assessment.

Teacher education programs may be instrumental in providing information about social disabilities to beginning teachers. If these teachers become aware of the neurological symptoms associated with neurodevelopmental disorder, they may alert parents early in the child's educational program. Early intervention for the child, parents, and siblings is crucial for this population.

For the classroom and support teachers in public school, these children posed unique problems. While each student identified with neurodevelopmental disability has different educational, social, and medical needs, teachers who provide a consistent and structured environment and a positive relationship with these children are most successful. The following are suggestions for classroom and support teachers:

- Conduct a functional assessment to determine how the child is performing in relationship to peers in his/her classroom.
- Develop individual programs which teach the child appropriate social skills in the classroom such as attending behavior, work completion, and peer interaction.
- Use Social Stories (Gray, 1995) to gain insight into the child's perspective and to teach the perspectives of other people.
- Develop a positive relationship with parents in order to share appropriate homework strategies, communication skills, and community resources. Be aware that some parents may share some of the same characteristics seen in their children. Open and honest communication between the school and parents is imperative.

Support teachers may find that utilizing Applied Behavior Analysis (ABA) in discrete trial training sessions is helpful with some children identified with AS (Alberto and Troutman, 1999). Determining functional developmental levels of communication and interaction using the guidelines advocated by Greenspan and Wieder (1998) may

also be helpful in designing appropriate educational programs for this population.

Implications for Research in the Classroom

In order to be successful, field-based research requires extensive preparation, planning, and communication. While each phase of this research study was carefully planned and orchestrated, there were still misunderstandings regarding the purpose and possible outcomes of the research.

The focus of this study was the child with AS and his performance in relationship to his peers. Because this was a new experience for the teachers involved in the study, they did not consider the impact that hosting a researcher for two weeks would have on them or the children in their classrooms. Even though the researcher communicated with the teachers, especially the classroom teacher, at least weekly via e-mail or through faxes during the six weeks prior to the two weeks of data collection, there were still problems in the implementation of the research project.

The pilot study developed by the researcher for the visual/imagery method had been conducted in isolation. This study was designed to gather information about the child with AS in relationship to his peers during the presentation of the concept attainment model in the classroom using the visual/imagery method as a support strategy. The implementation of the model in the classroom was new to the teachers and the researcher so it was uncertain during the training session how much time would be needed. The presentation of the model took no longer than fifteen minutes but the time needed for the students to write their processes took an additional fifteen minutes

per data set. For future research, the time needed to implement a strategy of this type would be a key factor for teachers and administrators.

Though every effort was made by the researcher to involve the teachers in a collaborative effort regarding the development and implementation of the project, the distance between the research site and the researcher posed a problem in establishing the rapport needed to implement the project smoothly. The following are suggestions for future research efforts in the classroom setting:

- Upon gaining permission to study, visit the research site to determine any possible problems before the study begins. Begin collecting data on the site, subjects to be investigated, and professionals who will be implementing the study.
- Enlist the support of the administration in the implementation of the research project even though he/she may not be directly involved in its development.
- Arrange a meeting to discuss the purpose of the research with the parents of all the children in the study and answer any questions they may have about the project.
- Allow an adequate amount of time to conduct the study. If during the implementation of the study adequate data collection is not obtained, make arrangements to revisit the site for additional data.
- Keep in mind the stress of learning a new technique for the classroom teacher as well as hosting a third party in his/her classroom.

Classroom research can provide a rich source of valuable data for school improvement or maintenance. Training teachers to use valid research practices in the classroom may lead to improved practice. Encouraging teachers to publish their research findings may provide an effective link between research and practice.

Summary

Public schools have been unaware of the unique needs of children with social disabilities. These children, in most cases, need consistent behavioral and educational intervention. Public awareness is the first step in the development of programs for these children and their families.

Several questions surfaced during this investigation which warrant further investigation. What services are appropriate for public schools to provide families who have children with neurodevelopmental disability? Some children may need counseling, medical attention, and one-on-one intensive treatment beyond the school day. To what extent are school districts responsible for these interventions when the child is functioning at a minimum level in the classroom? How can school districts make appropriate decisions about this disability when there is no consensus about the characteristics of the disability? Criteria for the diagnosis of AS need to be uniform across the medical, psychological, and educational fields for accurate identification and planned treatment strategies.

As stated in the literature review of this document, a void exists between research and practice regarding the Asperger Syndrome population. Schools may prove to be a vital link in the early identification and treatment of these children and their families. School personnel may be first to notice the signs of neurological dysfunction. Their response to these observations may be pivotal in the education of these students.

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APPENDICES

APPENDIX A

MATH DATA SET #1

MATH DATA SET #1

Yes	No
3 x 10 = 30	3 x 1 = 3
7 x 30 = 210	7 x 3 = 21
9 x 60 = 540	9 x 6 = 54
5 x 20 = 100	5 x 2 = 10
4 x 40 = 160	4 x 4 = 16
8 x 50 = 400	8 x 5 = 40
6 x 20 = 120	6 x 2 = 12

1st idea _____ Why?_____

_____

7 x 300 = 2100	7 x 31 = 217
9 x 600 = 5400	9 x 62 = 558
3 x 400 = 1200	3 x 44 = 132
5 x 200 = 1000	5 x 23 = 115
4 x 400 = 1600	4 x 41 = 164
8 x 500 = 4000	8 x 52 = 416
6 x 200 = 1200	6 x 27 = 162

2nd idea_____Why?_____

_____

7 x 3000 = 21,000	7 x 315 = 2205
9 x 6000 = 54,000	9 x 612 = 5508
3 x 4000 = 12,000	3 x 432 = 1296
5 x 2000 = 10,000	5 x 256 = 1280
4 x 4000 = 16,000	4 x 321 = 1284
8 x 5000 = 40,000	8 x 543 = 4344
6 x 2000 = 12,000	6 x 124 = 744

3rd idea _____ Why?_____

_____

APPENDIX B

STUDENT RESPONSE SHEET

Guesses	Reasons
1.	
2.	
3.	

VISUAL STUDENT RESPONSE SHEET AUDITORY

Name:_____ Date:_____

Subject:_____ Data Set:_____

APPENDIX C

CONCEPT ATTAINMENT MODEL WITH EXEMPLARS

CONCEPT ATTAINMENT MODEL WITH EXEMPLARS

YES	NO
6 + 5 = _____	4 + 3 = _____; then 7 - 2 = _____
6 - 2 = _____	5 - 3 = _____; then 2 + 1 = _____
4 + 2 = _____	5 + 7 = ____; then 12 - 2 = _____
5 - 4 = _____	4 + 2 = _____; then 6 - 1 = _____
7 + 2 = _____	6 - 4 = _____; then 2 - 1 = _____
9 - 3 = _____	20 + 1 = ____; then 21 - 4 = _____
12 - 2 = _____	4 + 4 = _____; then 8 - 5 = _____

APPENDIX D

PILOT STUDY EXEMPLARS

PILOT STUDY EXEMPLARS

One step problems:

Regina worked 27 hours. Louis worked 6 hours. How many more hours did Regina work than Louis?

Melody has 12 records. Paul has 6 records. How many records do they have in all?

Heather took 3 pictures of sailboats and 2 pictures of fishing boats. How many pictures of boats did she take altogether?

Two step problems:

Melody had 12 records. Paul had 6 records. Melody broke 2 records. How many do they have now?

Heather took 5 pictures of sailboats and 3 pictures of fishing boats. Heather lost two of the pictures. How many pictures does Heather have now?

Heather took 9 pictures of people swimming and 2 pictures of people diving. Five of the pictures had sea gulls in them. How many pictures did not have sea gulls in them?

Three step problems:

Regina worked 20 hours. Louis worked 6 hours. Dan worked 3 more hours than Louis. How many hours did they work in all?

Heather took 2 pictures of sailboats and 2 pictures of fishing boats. Her mother gave her one picture of a canoe. Heather gave two of her pictures to a friend. How many pictures does Heather have now?

Melody had 3 records. Paul had 6 records. Susan borrowed one record from Melody and 2 records from Paul. After Susan borrowed the records, how many more records does Paul have than Melody?

APPENDIX E

SPELLING DATA SET #1

SPELLING DATA SET #1

Yes	No
pot - potter	paint - painter
jog - jogger	write - writer
log - logger	sing - singer
rap - rapper	ring - ringer
win - winner	time - timer
sin - sinner	bomb- bomber
hop - hopper	rope - roper

1st idea

_____Why?_____

_____

trot - trotter	shine - shiner
thin - thinner	fine - finer
spot - spotter	line - liner
plod - plodder	mine- miner
swim - swimmer	climb - climber
trim - trimmer	lead - leader
sled - sledder	late - later

2nd idea

_____Why?_____

_____

bat - batter	joke - joker
sad- sadder	dust - duster
hot - hotter	wait - waiter
cut - cutter	make - maker
strip - stripper	fake - faker
mad - madder	rate - rater
pop - popper	vote - voter

3rd idea_____Why?_____

_____

APPENDIX F

SPELLING AND MATH DATA SETS #2

SPELLING DATA SET #2

YES	No
rob-robbed	robe-robed
grab-grabbed	sail-sailed
sob-sobbed	wail-wailed
web-webbed	flow-flowed
stop-stopped	mope-moped
blot-blotted	bomb-bombed
fit-fitted	wing-winged

1st idea_____ Why?_____

_____

run-running	ring-ringing
sun-sunning	fling-flinging
sob-sobbing	sign-signing
stop-stopping	mail-mailing
top-topping	send-sending
mop-mopping	remind-reminding
flag-flagging	speed-speeding

2nd idea_____ Why?_____

_____

shop-shopper	shop-shops
rot-rotting	rot-rots
chat-chatting	chat-chats
hop-hopped	hop-hops
flog-flogged	flog-flogs
bob-bobbing	bob-bobs
tan-tanning	tell-tells

3rd idea_____ Why?_____

_____

MATH DATA SET #2

Yes	**No**
1 x 8.3 = 8.3	1 x 83 = 83
1 x .05 = .05	1 x 5 = 5
1 x 1.1 = 1.1	1 x 1 = 1
1 x .03 = .03	1 x 3 = 3
1 x 2.2 = 2.2	1 x 22 = 22
1 x 1.2 = 1.2	1 x 12 = 12
1 x 5.5 = 5.5	1 x 55 = 55

1st idea_____ Why?_____

_____

10 x 8.3 = 83	10 x 83 = 830
10 x .05 = 0.5	10 x 5 = 50
10 x 1.1 = 11	10 x 11 = 110
10 x .03 = .3	10 x 3 = 30
10 x 2.2 = 22	10 x 22 = 220
10 x 1.2 = 12	10 x 12 = 120
10 x 5.5 = 55	10 x 55 = 550

2nd idea_____ Why?_____

_____

100 x 8.3 = 830	100 x 83 = 8300
100 x .05 = 5	100 x 5 = 500
100 x 1.1 = 110	100 x 11 = 1100
100 x .03 = 3	100 x 3 = 300
100 x 2.2 = 220	100 x 22 = 2200
100 x 1.2 = 120	100 x 12 = 1200
100 x 5.5 = 550	100 x 55 = 5500

3rd idea_____ Why?_____

_____

APPENDIX G

SPELLING AND MATH DATA SETS #3

SPELLING DATA SET #3

Yes	No
mope - moping	mop - mopping
tape - taping	tap - tapping
file - filing	fill - filling
pile - piling	poll - polling
fade - fading	fat - fatten
skate- skating	bat - batting
hate - hating	lag- lagging

1st idea_____Why?_____

_____

lope - loped	lap - lapped
rate - rated	rat - ratted
date - dated	mat - matted
hate - hated	can - canned
care - cared	fan- fanned
dare - dared	tan- tanned
use - used	sun - sunned

2nd idea_____Why?_____

_____

come - coming	comb - combing
refuse - refusing	dart - darting
pine - pining	grace - graceful
cope - coped	fate - fates
tune - tuned	hope - hopeful
tape- taped	toss - tossing
note- noting	knot - knotting

3rd idea_____Why?_____

_____

MATH DATA SET #3

Yes	**No**
6.2 x 2 = 12.4	.62 x 2 = 1.24
3.1 x 1 = 3.1	.31 x 1 = .31
2.3 x 2 = 4.6	.23 x 2 = .46
5.2 x 1 = 5.2	.52 x 1 = .52
2.2 x 4 = 8.8	.22 x 4 = .88
3.4 x 3 = 10.2	.34 x 3 = 1.02
4.6 x 2 = 9.2	.46 x 2 = .92

1st idea _____ Why? _____

_____

34.2 x 2 = 68.4	3.42 x 2 = 6.84
46.8 x 1 = 46.8	4.68 x 1 = 4.68
52.3 x 5 = 261.5	5.23 x 5 = 26.15
26.4 x 2 = 52.8	2.64 x 2 = 5.28
32.2 x 2 = 64.4	3.22 x 2 = 6.44
12.3 x 3 = 36.9	1.23 x 3 = 3.69
23.3 x 2 = 46.6	2.33 x 2 = 4.66

2nd idea _____ Why? _____

_____

123.3 x 2 = 246.6	12.33 x 2 = 24.66
134.2 x 2 = 268.4	13.42 x 2 = 26.84
468.8 x 1 = 468.8	46.88 x 1 = 46.88
234.4 x 2 = 468.8	23.44 x 2 = 46.88
223.3 x 3 = 669.9	22.33 x 3 = 66.99
412.2 x 2 = 824.4	41.22 x 2 = 82.44
714.2 x 3 = 2142.6	71.42 x 3 = 214.26

3rd idea

_____ Why? _____

_____

APPENDIX H

SPELLING AND MATH DATA SETS #4

SPELLING DATA SET #4

Yes	No
carry-carries	care-cares
marry-marries	mark-marks
penny-pennies	pen-pens
jelly-jellies	joy - joys
berry - berries	toy - toys
ferry - ferries	fear - fears
cherry - cherries	cheer - cheers

1st idea _____ Why?_____

_____

carry - carried	care - cared
marry - married	mark - marked
bury - buried	bill - billed
hurry - hurried	fill - filled
scurry - scurried	skill - skilled
party - partied	roll - rolled
deny - denied	punt - punted

2nd idea _____ Why?_____

_____

carry - carrying	care - caring
marry - marrying	date - dating
bury - burying	hurt - hurting
hurry - hurrying	hope - hoping
buy - buying	hike - hiking
lay - laying	light - lighting
stay - staying	dart - darting

3rd idea_____ Why?_____

_____

MATH DATA SET #4

Yes	**No**
$5 \times 5 = 25$	$5 + 5 = 10$
$8 \times 8 \times 8 = 512$	$8 + 8 + 8 = 24$
$3 \times 3 = 9$	$3 + 3 = 6$
$6 \times 6 \times 6 \times 6 = 1296$	$6 + 6 + 6 + 6 = 24$
$4 \times 4 \times 4 = 64$	$4 + 4 + 4 = 12$
$2 \times 2 \times 2 \times 2 = 16$	$2 + 2 + 2 + 2 = 8$
$3 \times 3 \times 3 = 27$	$3 + 3 + 3 = 9$

1st idea _____ Why? _____

_____

$10 \times 10 = 100$	$10 + 10 = 20$
$11 \times 11 = 121$	$11 + 11 = 22$
$12 \times 12 = 124$	$12 + 12 = 24$
$13 \times 13 = 169$	$13 + 13 = 36$
$14 \times 14 \times 14 = 2744$	$14 + 14 + 14 = 42$
$15 \times 15 \times 15 = 3375$	$15 + 15 + 15 = 45$
$16 \times 16 = 256$	$16 + 16 = 32$

2nd idea _____ Why? _____

_____

$20 \times 20 \times 20 = 8000$	$20 + 20 + 20 = 60$
$2^5 = 32$	$2 + 2 + 2 + 2 + 2 = 10$
$3^2 = 9$	$3 + 3 = 6$
$7^2 = 49$	$7 + 7 = 14$
$6^2 = 36$	$6 + 6 = 12$
$5^3 = 124$	$5 + 5 + 5 = 15$
$1^4 = 1$	$1 + 1 + 1 + 1 = 4$

3rd idea _____ Why? _____

_____

APPENDIX I

MATH AND SPELLING DATA SETS #5

MATH DATA SET #5

Yes	No
$1 \times 1 = 1^2$	$1 + 1 = 1 \times 2$
$2 \times 2 = 2^2$	$2 + 2 = 2 \times 2$
$3 \times 3 = 3^2$	$3 + 3 = 3 \times 2$
$4 \times 4 = 4^2$	$4 + 4 = 4 \times 2$
$5 \times 5 = 5^2$	$5 + 5 = 5 \times 2$
$6 \times 6 = 6^2$	$6 + 6 = 6 \times 2$
$7 \times 7 = 7^2$	$7 + 7 = 7 \times 2$
$8 \times 8 \times 8 = 8^3$	$8 + 8 + 8 = 8 \times 3$
$9 \times 9 \times 9 = 9^3$	$9 + 9 + 9 = 9 \times 3$
$1 \times 1 \times 1 = 1^3$	$1 + 1 + 1 = 1 \times 3$
$2 \times 2 \times 2 = 2^3$	$2 + 2 + 2 = 2 \times 3$
$3 \times 3 \times 3 = 3^3$	$3 + 3 + 3 = 3 \times 3$
$4 \times 4 \times 4 = 4^3$	$4 + 4 + 4 = 4 \times 3$
$5 \times 5 \times 5 = 5^3$	$5 + 5 + 5 = 5 \times 3$
$1 \times 1 \times 1 \times 1 \times 1 = 1^5$	$1 + 1 + 1 + 1 + 1 = 1 \times 5$
$3 \times 3 \times 3 \times 3 = 3^4$	$3 + 3 + 3 + 3 = 3 \times 4$
$2 \times 2 \times 2 \times 2 \times 2 = 2^5$	$2 + 2 + 2 + 2 + 2 = 2 \times 5$
$2 \times 2 \times 2 \times 2 = 2^4$	$2 + 2 + 2 + 2 = 2 \times 4$
$5 \times 5 \times 5 \times 5 = 5^4$	$5 + 5 + 5 + 5 = 5 \times 4$
$4 \times 4 \times 4 \times 4 = 4^4$	$4 + 4 + 4 + 4 = 4 \times 4$
$6 \times 6 \times 6 \times 6 = 6^4$	$6 + 6 + 6 + 6 = 6 \times 4$

SPELLING DATA SET #5

Yes	No
jumped	flag
played	phone
marked	tell
rolled	rob
darted	grab
cheered	fit
started	run

---

loped	lap
rated	rat
cared	can
dated	fan
dared	tan
used	sun
hated	mat

---

carried	care
married	skill
buried	punt
hurried	fill
scurried	roll
worried	mark
tarried	fear

APPENDIX J

MATH AND SPELLING DATA SETS #6

MATH DATA SET #6

Yes	No
1	.1
0	.9
3	.2
4	.4
5	.5
6	.6
2	.2

21	ONE-HALF
30	TWO-THIRDS
43	THREE-FOURTHS
35	ONE-SIXTEENTH
59	THREE-FIFTHS
62	ONE-FOURTH
50	NINE-TENTHS

100	.08
321	.32
432	.41
536	.65
214	.21
756	.86
490	.52

SPELLING DATA SET #6

Yes	No
bag	old
pat	art
hop	elf
pop	if
rat	is
hat	off
ban	on

---

stir	golf
trip	tack
swim	mark
plan	part
flag	camp
thin	pack
slim	tank

---

trim	stamp
hem	shack
dim	start
pet	smart
drip	skate
ship	shake
skip	stake

APPENDIX K

MATH AND SPELLING DATA SETS #7

MATH DATA SET #7

Yes	No
20 = 2 x 10	20 = 4 x 5
30 = 3 x 10	30 = 6 x 5
40 = 4 x 10	40 = 8 x 5
50 = 5 x 10	50 = 25 x 2
60 = 6 x 10	60 = 15 x 4
70 = 7 x 10	70 = 35 x 2
80 = 8 x 10	80 = 16 x 5
100 = 10 x 10	100 = 24 x 4
300 = 30 x 10	300 = 150 x 2
400 = 40 x 10	400 = 80 x 5
500 = 50 x 10	500 = 250 x 2
600 = 60 x 10	600 = 300 x 2
700 = 70 x 10	700 = 140 x 5
800 = 80 x 10	800 = 200 x 4
1000 = 100 x 10	1000 = 250 x 4
3000 = 300 x 10	3000 = 600 x 5
4000 = 400 x 10	4000 = 800 x 5
5000 = 500 x 10	5000 = 250 x 20
6000 = 600 x 10	6000 = 300 x 20
7000 = 700 x 10	7000 = 140 x 50
8000 = 800 x 10	8000 = 400 x 20

SPELLING DATA SET #7

Yes	No
marries	joys
duties	boys
carries	days
berries	bays
cherries	trays
parties	relays
hurries	stays

---

scurried	swayed
ferried	played
buried	keyed
flurried	delayed
varied	strayed
rallied	frayed
tallied	sprayed

---

scarier	layer
prettier	player
carrier	betrayer
bloodier	destroyer
gustier	sprayer
nastier	prayer
dustier	foyer

APPENDIX L

SPELLING AND MATH DATA SETS #8

SPELLING DATA #8

YES	NO
logging	singing
banning	darting
thinning	finding
stopping	handing
hopping	landing
popping	stacking
jogging	throwing

---

logged	darted
banned	stacked
thinned	handed
stopped	landed
hopped	tacked
popped	looked
jogged	hooked

---

bigger	singer
banner	swinger
thinner	filler
stopper	miller
hopper	longer
popper	higher
jogger	hanger

MATH DATA SET #8

YES	NO
$5 \times 5 = 25$	$5 \times 2 = 10$
$6 \times 6 = 36$	$6 \times 2 = 12$
$4 \times 4 = 16$	$4 \times 2 = 8$
$3 \times 3 = 9$	$3 \times 2 = 6$
$7 \times 7 = 49$	$7 \times 2 = 14$
$8^2 = 64$	$8 \times 2 = 16$
$9^2 = 81$	$9 \times 2 = 18$

$1 \times 1 \times 1 = 1$	$1 \times 3 = 3$
$2 \times 2 \times 2 = 8$	$2 \times 3 = 6$
$3 \times 3 \times 3 = 27$	$3 \times 3 = 9$
$4^3 = 64$	$4 \times 3 = 12$
$5^3 = 125$	$5 \times 3 = 15$
$6^3 = 216$	$6 \times 3 = 18$
$7^3 = 343$	$7 \times 3 = 21$

$1 \times 1 \times 1 \times 1 = 1$	$1 \times 4 = 4$
$2 \times 2 \times 2 \times 2 = 16$	$2 \times 4 = 8$
$3 \times 3 \times 3 \times 3 = 81$	$3 \times 4 = 12$
$1^5 = 1$	$1 \times 5 = 5$
$1^6 = 1$	$1 \times 6 = 6$
$2^5 = 32$	$2 \times 5 = 10$
$2^6 = 64$	$2 \times 6 = 12$

APPENDIX M

SPELLING AND MATH DATA SETS #9

SPELLING DATA SET #9

Yes	No
tossing	toss
kissing	kiss
missing	miss
telling	tell
killing	kill
darting	dart
singing	sing

---

moping	mope
hoping	hope
hating	hate
skating	skate
fading	fade
wading	wade
dating	date

---

jogging	jog
patting	pat
batting	bat
sitting	sit
letting	let
thinning	thin
swimming	swim

MATH DATA SET #9

Yes	No
2.4 x 10 = 24	24 x 10 = 240
3.2 x 10 = 32	32 x 10 = 320
5.1 x 10 = 51	51 x 10 = 510
6.2 x 10 = 62	62 x 10 = 620
1.1 x 10 = 11	11 x 10 = 110
8.4 x 10 = 84	84 x 10 = 840
7.1 x 10 = 71	71 x 10 = 710
2.41 x 10 = 24.10	241 x 10 = 2410
3.22 x 10 = 32.20	322 x 10 = 3220
5.14 x 10 = 51.40	514 x 10 = 5140
6.23 x 10 = 62.30	623 x 10 = 6230
1.11 x 10 = 11.10	111 x 10 = 1110
8.45 x 10 = 84.50	845 x 10 = 8450
7.12 x 10 = 71.20	712 x 10 = 7120
.241 x 10 = 2.410	24 x 100 = 2400
.322 x 10 = 3.220	32 x 100 = 3200
.514 x 10 = 5.140	51 x 100 = 5100
.623 x 10 = 6.230	62 x 100 = 6200
.111 x 10 = 1.110	11 x 100 = 1100
.845 x 10 = 8.450	84 x 100 = 8400
.712 x 10 = 7.120	71 x 100 = 7100

APPENDIX N

VISUAL AND AUDITORY TEST

Pre Post

Name:_____

Teacher:_____ Grade:_____

VISUAL TEST

Circle the word that is spelled correctly. Write a rule explaining why it is correct.

1. swimmer swimer

Rule_____

2. carries carrys

Rule_____

3. taged tagged

Rule_____

4. heming hemming

Rule_____

5. $4 \times 40 = 160$ $100 \times 16 = 160$

Rule_____

6. $1 \times 5.5 = 5.5$ $10 \times 5.5 = 5.5$

Rule_____

7. $5 \times 5 = 5^2$ $5 + 5 = 5^2$

Rule_____

AUDITORY TEST

Listen carefully to the directions and write the correct answer.

1. Write the whole number. _____
Definition_____
_____.

2. Write the number that is an exponent. _____
Definition_____
_____.

3. Write the number sentence that equals 300. _____
Why?_____
_____

4. Write the number sentence that equals 15.3. _____
Why?_____
_____

5. Write the number sentence that equals 22. _____

6. Write the word that has the last letter doubled when adding an ending. _____

7. Write the word that drops the "e" when adding "ing."_____

8. Write the word that changes the "y" to "i" before adding an ending._____

Auditory Test Questions

1. Of the following two numbers, write the whole number. Write the definition of whole number.	2	.5
2. Of the following two numbers, which one has an exponent? Write the definition of exponent.	7	8^3
3. Write the number sentence that equals 300.	100 x 30	100 x 3
4. Write the number sentence that equals 15.3.	1.53 x 10	15.3 x 10
5. Write the number sentence that equals 22.	2.2 x 10	2.2 x 100
6. Write the word that has the last letter doubled when adding "ed," "er," or "ing."	hop	start
7. Write the word that drops the "e" when adding "ing."	tree	tame
8. Write the word that changes the "y" to "i" before adding the ending.	carry	toy

APPENDIX O

SUBJECT CONSENT FORM

SUBJECT CONSENT FORM

Project Title: Elementary Children Diagnosed with Asperger Syndrome and the Implementation of the Concept Attainment Model

You are being asked to participate in a study about elementary children diagnosed with Asperger Syndrome.

This study is designed to help us understand better children diagnosed with Asperger Syndrome and identify methods that may be helpful in treating the lack of cognitive flexibility they exhibit in regular classroom situations.

Your child was selected for this study because you responded to a research advertisement distributed at a statewide conference of the Council for Exceptional Children in March 2001.

If you agree to participate, your child will be observed for ten academic days in her/his classroom and home environment. He/She will be taught a visual imagery method in conjunction with the concept attainment model to be used in the regular classroom. Children will be tested three times during the study in a pretest, post test, and a two week follow up test.

Procedures: Your child will be pretested along with all other students in his/her class for norming purposes. All students in his/her class will be taught the concept attainment model designed by Bruce Joyce and Marsha Weil. Your child will be taught the visual imagery method developed by Donald Deshler and Jean B. Schumaker in conjunction with the concept attainment model using poker chips as a memory aide in isolation. Data will be taken to determine the change in problem solving ability, if any, which takes place in the regular classroom.

There is a risk in this study of sharing confidential information regarding a child with a disability. The research process is long and involves the sharing of personal information which may be uncomfortable for the child, parents, or others working with the child.

The study is of no benefit to you.

If you should decide not to participate, please let us know immediately so that another subject can be selected for the study.

This study is conducted with scholarship funds made available through Delta Kappa Gamma International. There is no cost to you to participate.

If you have any questions, please do not hesitate to call Marilyn Sue Hamilton at 406-585-7497 at any time before, during, or after the study.

Confidential psychological and medical records will be used as part of this study. All identifying information will be removed from copies of the information and every effort will be made to protect the identity of the student and his/her family.

This investigator will treat the identity of your child with professional standards of confidentiality. However, the U.S. Department of Health and Human Services have the right to inspect all of your medical records for the purpose of verifying data. The information obtained in this study may be published in medical or psychological journals, but your identity will not be revealed.

In the event your participation in this research directly results in injury to you medical treatment consisting of psychiatric help will be available, but there is no compensation for such injury available. Further information about this treatment may be obtained by calling Marilyn Sue Hamilton at 406-585-7497.

Additional questions about the rights of human subjects can be answered by the Chairman of the Human Subjects Committee, Mark Quinn, at 406-994-5721.

AUTHORIZATION: I have read the above and understand the discomforts, inconveniences and risks of this study. I _____ (name of the parent/ guardian), related to the subject as _____ (relationship), agree to the participation of _____(name of the subject) in this research. I understand that the subject or I may later refuse participation in this research and that the subject, through his/her own action or mine, may withdraw from the research at any time. I have received a copy of this consent form for my own records.

APPENDIX P

REVISED ANSWER SHEET

REVISED ANSWER SHEET

Initials:_____ Date:_____
Subject:_____ Data Set:_____

1st idea_____
_____
_____
_____
_____

2nd idea_____
_____
_____
_____
_____

3rd idea_____
_____
_____
_____
_____

What was my entire idea?_____
_____
_____
_____
_____

APPENDIX Q

ANSWER SHEET FOR MATH DATA SET #8

ANSWER SHEET FOR MATH DATA SET #8

Initials:_____ Date:_____
Subject: Math Data Set #8

Please circle the correct idea.

1. Numbers times two.

   Numbers multiplied times two.

   Numbers squared.

2. Numbers time three.

   Numbers cubed or to the third power.

   Numbers multiplied times three.

3. Numbers multiplied by four, five or six.

   Numbers multiplied to the fourth, fifth or sixth power.

   Numbers times four, five or six.

4. Numbers multiplied by themselves to the second, third, fourth, fifth or sixth power.

   Numbers multiplied by two, three, four, five or six.

   Numbers times two, three, four, five or six.

APPENDIX R

ANSWER SHEET FOR SPELLING DATA SET #8

ANSWER SHEET FOR SPELLING DATA SET #8

Initials:_____ Date:_____
Subject: Spelling Data Set: #8

Please circle the correct idea.

1. Words adding the "ing" ending.

   Words with the CVC pattern adding the "ing" ending.

   Dropping the "e" and adding a final consonant.

2. Words with the CVC pattern adding the "ed" ending.

   Words adding the "ed" ending.

   Dropping the "e" and adding a final consonant.

3. Words with the CVC pattern adding the "er" ending.

   Words adding the "er" ending.

   Dropping the "e" and adding a final consonant.

4. Words that dropped the "e" and added a final consonant.

   Words with the CVC pattern adding "er", "ed", and "ing".

   Words adding the endings "er", "ed", and "ing".

APPENDIX S

ANSWER SHEET FOR MATH DATA SET #9

ANSWER SHEET FOR MATH DATA SET #9

Initials:_____ Date:_____
Subject: Math Data Set #9
Please circle the correct answer.

1. Decimals multiplied by 10 equal the same number.

   Numbers with a decimal in the tenths place multiplied by 10 equal the same number.

   Numbers with a decimal in the tenths place multiplied by 10 move the decimal over one place to the right in the answer.

2. Decimals multiplied by 10 equal the same number.

   Numbers with a decimal in the hundredths place multiplied by 10 move the decimal over one place to the right in the answer.

   Numbers with a decimal in the hundredths place multiplied by 10 equal the same number.

3. Decimals multiplied by 10 equal the same number.

   Numbers with a decimal in the thousandths place multiplied by 10 move the decimal over one place to the right in the answer.

4. Numbers with a decimal in the tenths, hundredths or thousandths place multiplied by 10 move the decimal over one place to the right in the answer.

   All decimals multiplied by 10 equal the same number.

   Numbers with decimals multiplied by 10 equal the same number.

APPENDIX T

ANSWER SHEET FOR SPELLING DATA SET #9

ANSWER SHEET FOR SPELLING DATA SET #9

Initials:_____ Date:_____

Subject: Spelling Data Set #9

1. Adding "ing" to words ending in two consonants.

   Doubling the consonant to add "ing."

   Dropping the "e" and adding "ing."

2. Adding "in" to words ending in two consonants.

   Dropping the "e" and adding "ing."

   Adding "ing" to words with the CVC pattern.

3. Add "ing" to words ending in two consonants.

   Dropping the "e" and adding "ing."

   Adding "ing" to words with the CVC pattern.

4. Dropping letters to add "ing."

   Different ways of adding "ing" to different morphographs.

   Doubling consonants to add "ing."

APPENDIX U

CONCEPT ATTAINMENT MODEL