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# Reading flexibility and its effect on comprehension in students with Autism Spectrum Disorder (ASD)

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# Reading Flexibility and its Effect on Comprehension in Students with Autism Spectrum Disorder (ASD)

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**Abstract**

Reading flexibility exercises were conducted over a six-week period with a fourth grade student with Autism Spectrum Disorder (ASD) to determine whether they would increase reading flexibility as well as comprehension. Cartwright's (2010) reading flexibility assessment and exercises along with the Qualitative Reading Inventory-5 (QRI; Leslie & Caldwell, 2011) word lists and passages were administered. To ensure the intervention was "autism friendly," assessments and exercises were altered so that visuals were used and activities were predictable. Based upon assessments administered, the participant made gains in both reading flexibility and reading comprehension skills. Further research must be conducted with a larger sample to determine whether this is an effective intervention for other students with ASD.

# Chapter One

# Introduction

## Statement of the Problem

Samuels (2004) stated that with practice, people are able to perform more than one task at a time. This is called automaticity. However, a person's attention can only be truly focused on one process in a single instant. For a beginning reader this is decoding, and for a fluent reader this is comprehension of sentences and passages. In order for a reader to comprehend text, they must have the ability to automatically decode words. When a person is able to automatically decode, and switch their attention back and forth between decoding and comprehending, they are able to think about more than one aspect of text at one time and in different ways. This is called reading flexibility.

As a Special Education teacher in an elementary school, I work with students across grade levels and with varying skills and abilities. While I find that each child has exceptionally unique needs, the demand for intense reading instruction is something they all have in common. Some require a program that focuses on phonics, while others need the focus to be on comprehension. Quality reading instruction is important for all students. In fact, the Common Core State Standards, which support educators by giving them a guideline for teaching core concepts in a way that allows students to master them, put literacy as a focus in all academic areas, with comprehension at its center. Learning to read and understand text is essential to learning in all subjects. In addition, the Wisconsin Extended Grade Band Standards, which assist educators in teaching students with significant disabilities by indicating what students are expected to know and accomplish academically at all levels of learning, put comprehension of

literacy as a focus in all areas just like the Common Core State Standards. Literacy skills are essential for all students.

Over the past few years I have had the opportunity to work with several students with Autism Spectrum Disorder (ASD), and this has become a passion of mine. While working with the subject of this action research, I noticed that she had the ability to read and decode, but did not possess the skills to comprehend. She sounded like a fluent reader, but was unable to answer even simple comprehension questions. I realized that she was not a flexible reader. While she was able to decode automatically, which should have therefore allowed her to focus her attention solely on comprehension so that both tasks could be done simultaneously, this student was not remembering what she had read, suggesting that she was not putting her attention on comprehending the text, but instead thinking about other things entirely. This student needed to learn how to focus on text meaning. I began to wonder if this reading difficulty was a common in students with ASD, and I felt I had an obligation to find a way to tap into and use this student's learning styles to my advantage to teach her to become a flexible reader.

Throughout my research I found that this issue with reading comprehension and flexibility was not limited to my student. Many students are able to read the words, but lack in comprehension (Cartwright, 2002; 2006; 2007; 2010). This problem, however, is especially prevalent in students with ASD (Huemer & Mann, 2010; Nation, Paula, Wright, & Williams, 2006). Research indicates that students with ASD frequently have average or above average decoding skills (Frith & Snowling, 1983; Griswold et. Al., 2002; O'Connor and Klein, 2004), yet their reading comprehension is commonly lower than expected for their level of word reading ability (Minishew et al., 1994; O'Connor & Hermelin, 1994). Children with ASD are often not

flexible readers because reading flexibility requires them to read and create meaning of texts simultaneously, and comprehension is typically not a strength. I found Cartwright (2002; 2006; 2007; 2010) to be at the center of much of the research on reading flexibility. She had created a reading flexibility assessment as well as reading flexibility exercises. However, this research had not yet been tested with students with ASD.

I hypothesized that implementing reading flexibility exercises with a student with ASD would increase her reading flexibility, and in turn increase her reading comprehension. The focus of my research was the development of cognitive flexibility, reading flexibility, ASD and reading comprehension, and ASD and visual supports. I used this research, along with Cartwright's (2010) reading flexibility exercises and the Qualitative Reading Inventory-5 (QRI; Leslie & Caldwell, 2011), to create assessments and to implement a six-week intervention that could be considered "autism friendly." This meant altering the assessments and intervention so that visuals were used and activities were predictable. This study was executed as a case study with one fourth grade female student with ASD. Reading flexibility and reading comprehension assessments were administered before and after the intervention period, and all activities were completed in a one-on-one setting within the participant's regular reading class period. The research behind this action research is discussed in the following chapter.

**Key Terms**

Autism Friendly- assessments, interventions, and teaching styles that take into account ASD characteristics, and use research-based strategies to allow students with ASD to experience success.

Autism Spectrum Disorder (ASD): a group of brain disorders that are characterized by

difficulties in social interaction, verbal and nonverbal communication, and repetitive behaviors. Disorders include autism, pervasive developmental disorder-not otherwise specified (PDD-NOS), Asperger syndrome, Rett syndrome, and childhood disintegrative disorder ("Autism Speaks," 2012).

Cognitive Flexibility: the ability to think flexibly and manage more than one aspect at a time (Piaget, 1972).

Independent Level: in terms of reading, this is the level students can decode and comprehend with very few errors and without outside assistance.

Instructional Level: in terms of reading, this is the level at which students need scaffolding and some assistance to experience success with decoding and/or comprehension.

Frustration Level: in terms of reading, this is the level that, even with assistance, students are unable to decode and/or comprehend.

Passage Comprehension: the process of making meaning of the text in a specific passage.

Reading Comprehension: the overall process of making meaning of text.

Reading Flexibility: the ability to read and decode words as well as create meaning simultaneously (Cartwright, 2002; 2006; 2010).

Reading Level: the level a person reads at based on word identification and passage comprehension skills.

Word Decoding: applying knowledge of letter-sound relationships to correctly pronounce words.

Word Identification: the process of reading words.

Word Callers: readers who are able to decode words with fluency, but have little to no comprehension of what they are reading (Cartwright, 2006; 2010).

# Chapter Two

## Review of Literature

In order to be flexible readers, students must be able to read and create meaning of texts simultaneously (Cartwright, 2006). Unfortunately, many students are able to read the words, but are lacking in their abilities to comprehend. This is especially true of students with autism spectrum disorder (ASD; Huemer & Mann, 2010; Nation, Paula, Wright, & Williams, 2006). Students with ASD are often reported as having average or above average decoding skills (Frith & Snowling, 1983; Griswold et. Al., 2002; O'Connor and Klein, 2004), while their reading comprehension is frequently lower than expected for their level of word reading ability (Minishew et al., 1994; O'Connor & Hermelin, 1994). As a result, children with ASD are often not flexible readers.

This literature review contains twelve articles covering issues related to reading flexibility in students with ASD. The articles are divided up into four separate sub-categories. The first section contains three articles exploring the development of cognitive flexibility, beginning with the preschool years and continuing into adolescence and adulthood. The second section contains four articles that investigate the role that reading flexibility plays in reading comprehension. The third section consists of three articles that examine the connection between decoding and comprehension skills in students with ASD. Finally, the fourth section consists of two articles that discuss the importance of using visual supports with students with ASD, and how those supports may improve communication and assessment skills.

### Development of Cognitive Flexibility

The three articles in this section focus on the development of cognitive flexibility in

preschool and elementary children, and into adulthood. Cognitive flexibility is the ability to manage more than one aspect at a time, and this skill develops in children over the elementary school years (Piaget, 1972). During the preschool years, children develop the ability to follow perceptual rules, and to switch back and forth between rules (Baker, Friedman, & Leslie, 2010). Later, children begin to develop the ability to distinguish semantic relationships and categorize based on meaning (Blaye, Chevalier, & Paour, 2007). The following study investigates the advances made by children at the preschool age.

Baker, Friedman, and Leslie (2010) explored the problem that preschoolers are often limited in tasks that require them to think flexibly. The researchers wanted to determine whether preschoolers would demonstrate limitations when they were asked to apply a general rule across changing stimuli while requiring varying responses. The study consisted of conducting assessments on preschool children, and the research method was quantitative.

The sample consisted of 244 children, 115 boys and 129 girls. Of those children there were sixty-seven three-year-olds, one hundred four-year-olds, and seventy-seven five-year-olds. The children were randomly placed into one of four different assessment groups. Children were tested individually, and each testing block consisted of two sets of trials. The first set of trials was training trials, and the second set of trials was testing trials. Children were provided with two training trials and six testing trials.

At the beginning of each trial, children were either given a congruent or an incongruent rule. A congruent rule required children to follow the direction they were given, while an incongruent rule required children to perform the opposite of the direction they were given. Once given the rule, they were then shown two pictures that semantically opposed each other,

and the experimenter named one of the pictures. Those given a congruent rule were told to point to the picture of the word that was said. For example, the student would point to an open door after hearing the word "open." Those given an incongruent rule were told to point to the other picture. For example, they would point to a closed door after hearing the word "open." The trials of the assessment blocks were either congruent training-congruent testing, congruent training-incongruent testing, incongruent training-incongruent testing, or incongruent training-congruent testing. Therefore, some children were provided with the same rule for both sets of trials, while other children were given a different rule for the second set of trials.

Unlike many other flexibility tasks designed for preschoolers, this task assessed the children's abilities to overcome both response interference and proactive interference. Response interference is when children are asked to go against a reflexive tendency, for example, they have to say the answer is "night" when they are actually looking at a picture of "day." This was assessed when children were given an incongruent rule. Proactive interference is when children must overcome a previous rule in order to give the correct answer, for example, after being asked to sort by one dimension, they must now sort the same cards by a second dimension. This was assessed when students had the rule changed for the second set of trials.

The training and testing trials were scored differently. For the training portion, if students answered the first trial correctly, they received a score of one and moved on to the testing portion. If the student answered the first trial incorrectly and the second trial correctly, they received a score of two, and if they answered both incorrectly, they obtained a score of three. The testing portion of the assessment block consisted of six test trials. Children received one point for each correct response.

The researchers found that, overall, five-year-old students were more successful than three-year-old students in each of the four different assessment groups. In addition, three-year-old students had considerably more difficulty learning the incongruent rule. This demonstrates that students gain flexibility in their thinking with age. Additionally, there were other trends in the data. The researchers found that it was easier for students to learn the congruent rule than the incongruent rule during training, and it was easier for them to apply the congruent rule during the testing phases. Also, it was easier for students to demonstrate understanding of a rule during the testing trials if they had learned that same rule during the training trials. Children who had the rules switched for the testing trials performed worse. They had the most difficulty when they began with the congruent rule, and then had to switch rules and apply the incongruent rule during the testing trials. This study, like the following study, demonstrated that children develop the ability to think flexibly with age. The following study, however, demonstrates that it may be possible to use strategies to help children think with more flexibility.

Kloo and Perner (2005) explored whether separating the dimensions on the cards of the dimensional change card-sorting (DCCS; Frye, Zelazo, & Palfai, 1995; Zelazo, Frye, & Rapus, 1996) task would increase performance of three-year-olds, and if separating the dimensions on test or target cards would create higher results. The researchers hypothesized that children would perform better when the dimensions on the test cards were separated. The research method was quantitative.

Forty-eight children, twenty-seven girls and twenty-one boys, from five nursery schools in Austria participated in this study. The children's ages ranged from 3.0 to 4.7 years.

Children were divided into groups of twelve, and each group was administered a different

version of the test. All of the testing required children to sort a set of test cards into boxes that each had a target card attached, cueing them on how to sort. One group of children received the standard version of the DCCS task, where they sorted test cards (e.g. blue banana) first according to one dimension (e.g. color) and then by another dimension (e.g. shape). Another group was given a version with dimensions separated on both the test and target cards. For example, instead of a picture of a blue banana, the card would have a picture of a blue circle next to an outline of a banana. A third group was administered a version with dimensions separated only on test cards, and the last group received a version with dimensions separated only on target cards.

Each child was tested individually, and each task involved a pre-switch and a post-switch phase. Children were first asked to sort five test cards by one dimension, color or shape. They had to place a test card in a box that had a matching target card attached. Once that task was completed, they were asked to switch and sort the same five cards into the boxes by the other dimension. On each trial the children were told whether they had sorted correctly. When a card was sorted incorrectly, the experimenter repeated the rules.

Data was collected to determine the number of correct responses during both the pre-switch and post-switch phases of the card-sorting tasks for each child. Results indicated that in the pre-switch phase of all four card-sorting versions of the DCCS task, children of all ages almost always scored perfectly. This phase did not require children to think flexibly, so both three-year-olds and four-year-olds were able to sort the cards with accuracy.

The post-switch phase yielded different results. Three-year-olds administered the standard DCCS task had much more difficulty switching the sorting dimension than four-year

olds. As expected, they were not yet able to think flexibly (Kloo & Perner, 2005). Also as hypothesized, separating the dimensions on the test cards yielded significantly higher scores for all children. Children seemed to focus their attention on the test cards, and disentangling the two dimensions on those cards enhanced children's abilities to switch sorting criterion because it eliminated the need to describe one picture in different ways (Kloo & Perner, 2005). Separating the dimensions on the target cards did not produce significantly higher scores than the standard DCCS task, and separating dimensions on both the test and target cards did not produce significantly higher scores than only separating dimensions on the test cards.

Overall, this study demonstrated that children gain flexibility with age. However, because separating the dimensions on the test cards increased performance in all children, it can also be stated that there are strategies that may assist children in thinking with more flexibility. While there are many important gains in children's abilities to think flexibly during the preschool years, those advances continue into adolescence and even adulthood.

Blaye, Chevalier, and Paour (2007) investigated the development of the flexible use of categorization rules based on semantic relations. The purpose of their study was to explore the development of categorical flexibility, the ability to consider an object as a member of many categories. Thematic categorization, matching objects that can be met in a common scene or event, and taxonomic categorization, matching objects of a same sort, were both assessed. The main focuses of the study were to examine the ability to maintain one type of categorization across a series of objects when another potential categorization is available (for example, choose a thematic match when a taxonomic match is available), and the ability to switch to a different categorical rule (for example, switch from making thematic matches to making taxonomic

matches). The research method was quantitative.

The sample consisted of four groups of children and one group of adults. Children were grouped by age, with thirty five-year-olds, thirty six-year-olds, thirty eight-year-olds, and thirty ten-year-olds. They were acquired from two preschools and one primary school located in small towns in France. The adult group consisted of thrity university students with a mean age of twenty-one.

The task was divided into three phases that required increasing categorical flexibility, and was administered on a computer. For each trial a display of three pictures was presented, and the participant was asked to eliminate one picture in order to leave two pictures that matched according to the categorical relation, either thematic or taxonomic. Participants moved from one phase to the next after completing five consecutive correct responses, which had to be reached in a maximum of twenty trials. If the participant did not reach that criterion by the twentieth response, the task was stopped and the participant did not move on to the next phase.

In phase one only two of the three pictures could match, there was no interfering picture. The purpose of this phase was to familiarize the participants with the format of the task, and to present them with a categorical relation to follow, either thematic or taxonomic. In the second phase participants were given three pictures that could be matched either thematically or taxonomically, and they had to keep the same categorical relation that had been positively reinforced in phase one. Finally, in phase three participants had to switch to the other categorical relation. For example, if they had been matching thematically, they would switch to matching taxonomically, and vice versa.

Results indicated that there are many changes in flexibility between the ages of five and

adult. All groups were able to complete phase one with no difficulty, showing that knowledge of specific associations is already acquired by age five (Blaye, Chevalier, & Paour, 2007). In phase two, performance decreased in five and six-year-old children, who were not always able to maintain the categorical relationship when there was an alternate match possible. Furthermore, children five to eight had difficulty switching and maintaining categorical relations in phase three. Adults and ten-year-olds were both able to control their use of both matching relations. They performed with the same level of success in the phases, although adults made significantly fewer errors. Overall, thematic relations proved to be easier than taxonomic relations. More participants passed the reversal phase when they were switching from taxonomic to thematic matches, and vice versa. In addition, young children were better at maintaining thematic relations than taxonomic relations once they were in phase two. It was evident that major developments occur in relational flexibility between the ages of five and ten.

As a result of the findings of the preceding studies, it is apparent that the ability to think flexibly improves with age, and that many advances are made in children's cognitive flexibility between the ages of three and ten (Baker, Friedman, & Leslie, 2010; Blaye, Chevalier, & Paour, 2007; Kloo & Perner, 2005). In the preschool years, children develop the ability switch back and forth between perceptual rules (Baker, Friedman, & Leslie, 2010), and while older children tend to demonstrate more accuracy with flexibility tasks, there are strategies, such as separating the dimensions, that may assist them in being more successful (Kloo & Perner, 2005). Furthermore, between the ages of five and ten children gain the ability to match semantically and switch between categorical rules (Blaye, Chevalier, & Paour, 2007). The ability to think semantically will continue to assist students with more than thinking flexibly. It will help them make meaning

of texts as they learn to read flexibly.

**Reading Flexibility**

The four articles in this section focus on reading flexibility in elementary students and into adulthood. During the elementary school years, children begin to combine mental actions, and then coordinate these actions into overall systems (Piaget, 1972; Piaget & Inhelder, 1969). Reading is an act that requires many mental actions, including phonological and semantic processes, and over the elementary years these processes are coordinating into an overall system for reading (Cartwright, 2002). Unfortunately, many children at the elementary level can be described as "word callers" (Cartwright, 2006). Word callers are able to read and decode beautifully, but they have little to no comprehension of what they are reading. In order to be a flexible reader, students must be able to read and create meaning simultaneously. The following articles describe the role that reading flexibility plays in reading comprehension.

Cartwright, Marshall, Dandy, and Isaac (2010) examined the development of graphophonological-semantic flexibility in beginning readers. They conducted a study to test the hypotheses that second-grade children would score higher than first-grade children on general color-shape and graphophonological-semantic flexibility assessments, that children would score significantly higher on a color-shape flexibility task than on a graphophonological-semantic flexibility task, that children's exposure to print would contribute significantly to children's graphophonological-semantic flexibility, and that graphophonological-semantic flexibility would make a significant contribution to reading comprehension. The research method was quantitative, and it consisted of performing a series of assessments on a variety of children.

The sample consisted of sixty-four first and second grade children at urban, public

elementary schools. Of the sixty-four students, thirty-six were girls and twenty-eight were boys, while thirty-one were in first grade and thirty-three were in second grade. The sample was diverse and included twenty-five minority students. All of the children had scored within the normal range on a standardized measure of verbal ability (Kaufman & Kaufman, 1990).

Each child was individually tested using a variety of assessments, with the order of the tests being balanced across the children. The Woodcock Reading Mastery Tests- Revised (WRMT-R; Woodcock, 1987) was used to test word attack and passage comprehension skills. The Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990) was used to determine verbal ability, which controls semantic processing. Students were also administered a variety of flexibility tasks to test their cognitive flexibility. After these tasks were administered, all children completed the Title Recognition Test (TRT; Cunningham & Stanovich, 1990), which assessed each child's reading experience, specifically, their exposure to print

The cognitive flexibility tasks consisted of classification tasks designed to assess both general color-shape flexibility and graphophonological-semantic flexibility. The procedures for these two different tasks were identical. Children were given a set of cards and told that they could sort them in two different ways, and they sorted using a two-by-two matrix. For the graphophonological-semantic flexibility task they were told to sort the cards by how they sounded and what they meant. For the general color-shape flexibility task they were told to sort the cards by what color they were and what kind of thing they were. The researcher demonstrated each task by placing four cards into the two-by-two matrix so that they were sorted by one dimension along the horizontal axis, and the other dimension along the vertical axis. After given an explanation of how they sorted the cards, children were asked to do this task on

their own. Children had to then give an explanation for how they sorted each set of cards, and sorting time was recorded for each task.

Cognitive flexibility was assessed based on accuracy and speed. Children were able to receive up to twelve points, three points per sort, for being able to both sort correctly and give a correct explanation. The WRMT-R, K-BIT, and TRT were all scored based on standardized test scores.

The researchers found that their hypotheses were correct. The second graders scored considerably higher than the first graders on both graphophonological-semantic and color-shape cognitive flexibility tasks, furthermore, as expected, the general flexibility task was easier than the graphophonological-semantic flexibility task for all children involved in the study. This demonstrated that cognitive flexibility improves with age, and, assuming that children have had more experience with colors and shapes than with decoding words and meanings, that children are able to think more flexibly while doing tasks with which they have more experience (Cartwright et al., 2010). Also, reading experience had a positive impact on children's graphophonological-semantic flexibility, while graphophonological-semantic flexibility had a significant impact on children's reading comprehension. Again, this demonstrated that children's exposure to a task increases their success, and that their ability to think flexibly while reading reflects an increase in reading comprehension. In conclusion, the researchers determined that reading flexibility is a predictor of reading comprehension, even in beginning readers. While this study demonstrated that children gain flexibility with age and that reading flexibility is a predictor of reading comprehension, the following study establishes that reading flexibility makes a contribution to reading comprehension above that of general flexibility.

Cartwright (2002) explored the problem that struggling readers are often not able to think flexibly, signifying they put all of their focus into decoding words and are, as a result, unable to think about meaning. A study was conducted to examine the relation of reading flexibility to children's reading comprehension skills. It was hypothesized that the contribution made by reading-specific flexibility would outweigh the contribution made by general flexibility. The research method of this study was quantitative.

The site and sample consisted of forty-four children in second through fourth grade regular elementary classrooms at a suburban Midwestern U.S. elementary school. The researcher met with each student individually, and they completed a series of assessments in a session that lasted approximately one hour. Decoding ability was assessed using the Word Attack subtest of the Woodcock Reading Mastery Tests-Revised (WRMT; Woodcock, 1987) Form G, comprehension was assessed using the WRMT Passage Comprehension subtest Form G, and language comprehension was assessed using the Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990) Verbal subscale. In addition, children completed a general multiple classification (GMC) task as well as the reading-specific multiple classification (RMC) task to assess flexibility.

GMC tasks require that objects be sorted on two or more dimensions simultaneously, for example, by both color and shape (Cartwright, 2002). The researcher adapted this type of task to be reading-specific. In the RMC task, printed words were to be sorted on two dimensions simultaneously as well, both phonologically and semantically. This demonstrated a person's ability to think flexibly about reading by sorting words according to both how they look and what they mean.

When administered the GMC task, students were asked to sort four sets of twelve cards into a two-by-two matrix along two dimensions simultaneously. Each card portrayed a picture of an object, and it could be classified by both color and type of object. The task was first demonstrated for the student with one set of cards, and they were then expected to sort the remaining four sets independently. Children were given points based on correctly sorting the cards, as well as justifying their sorts with a correct explanation. The RMC task was administered in the same way, however each card had a printed word that could be sorted in two ways, both phonologically and semantically.

As hypothesized, there was a significant positive correlation between RMC skill and reading comprehension, and this outweighed the correlation between GMC skill and reading comprehension. In addition, the relationship between RMC skill and reading comprehension was more significant than that of reading comprehension to both decoding ability and linguistic comprehension. As result, it can be concluded that reading-specific cognitive flexibility made an independent contribution to reading comprehension, beyond that of general flexibility. While this study demonstrated that reading flexibility made a unique contribution to reading comprehension, the following study establishes that children may be able to be taught to think more flexibly about reading, and therefore increase their reading comprehension.

In response to the previous study, Cartwright (2002; 2006) conducted a study to determine whether children could be taught to think more flexibly about the phonological and semantic aspects of text, and whether reading-specific flexibility exercises would increase their reading comprehension. The hypothesis was that students who participated in reading-specific flexibility exercises would make gains in reading comprehension, while those who participated

in general flexibility exercises would not. The research method was quantitative.

The site and sample consisted of thirty-six children in second through fourth grade regular elementary classrooms at a suburban Midwestern U.S. elementary school. They had worked with the researcher on the previous flexibility study, so they were already familiar with the flexibility tasks. The children were randomly split into three groups, each consisting of twelve students.

The independent variables were the implementation of two different interventions. The first intervention group practiced reading-specific flexibility exercises, and the second intervention group practiced general flexibility exercises. A third group, the control group, played dominoes when they met with the researcher to ensure that they would not make gains in their reading flexibility. The dependent variables consisted of student performance on reading assessments. The Woodcock Reading Mastery Test-Revised (WRMT; Woodcock, 1987) Passage Comprehension subtest Form H was used to assess reading comprehension, while reading-specific flexibility tests using word sets different from those used during sessions were used to assess reading flexibility.

Each student individually met with the researcher for fifteen minutes a day over a period of five days. The children practicing reading-specific flexibility exercises performed tasks that required them to sort word cards, and these tasks occurred in two phases: reclassification and matrix completion. During the reclassification phase students were asked to sort the stack of word cards along one feature: either phonologically or semantically. For example, a student could first be asked to sort the word cards according to their beginning letter sound. Next, after the cards were reshuffled, the student could be asked to sort the words for meaning (ex. foods vs.

non-foods). The purpose of the reclassification phase was to familiarize the student with the words, and to see that they were able to attend to the words in both a phonological and a semantic manner. If a student incorrectly placed a card, the card was immediately placed in the correct pile and an explanation was given.

Once the student was able to correctly sort the word set both phonologically and semantically, they entered the matrix completion phase. During this phase they were given a two-by-two matrix with places for four word cards. The researcher placed three cards in the matrix so that they were sorted semantically along one axis and phonologically along another. The student was then given the remaining cards and asked to fill in the last card on the matrix. If the student placed an incorrect card, they were corrected and given an explanation. Once they provided four consecutive correct responses with a word set on a given day, the session was complete.

Data collection consisted of a pre and post-test. Once children had worked with Cartwright for five days, they were re-tested using the WRMT Passage Comprehension subtest to determine whether or not there was an increase in their abilities to comprehend text, and given reading-specific flexibility exercises to determine if there was in increase in their reading flexibility.

Results showed that children who practiced the reading-specific flexibility exercises made significant gains in both reading comprehension and reading flexibility. Students had an average increase of 4.42 items correct on the WRMT Passage Comprehension subtest, and they showed significant increases in the reading-specific flexibility exercises as well. Children in the general flexibility and control groups showed no improvements on the tests. Therefore,

Cartwright's (2002; 2006) hypothesis was correct. Children who practiced reading-specific flexibility exercises made gains in reading comprehension, while those who participated in general flexibility tasks made no gains. While the previous studies have established the importance of reading flexibility in the elementary school years, reading flexibility influences adult reading skills as well.

Cartwright (2007) conducted a study examining reading skills of adults. The investigation analyzed the relationship between graphophonological-semantic flexibility (GSF) and reading comprehension, and it examined three purposes. First, it was hypothesized that GSF would make a unique contribution to adults reading comprehension skills over that of phonological and semantic processing alone. Second, the study assessed the relationship between reading experience and GSF. Finally, it examined the simple view of reading in light of work on GSF. The simple view of reading (Gough, Hoover, & Peterson, 1996) argues that reading comprehension equals the product of decoding skill and language comprehension. Cartwright (2007), however, argues that even if an individual tests high in both phonological and semantic assessments, they may not have the ability to flexibly engage in these processes simultaneously. Therefore, the researcher hypothesized that GSF would make a contribution to reading comprehension independent of the simple view of reading. The research method was quantitative.

The site and sample consisted of forty-eight undergraduate students who attended a small, private Northeastern liberal arts college. Twenty-four were men and twenty-four were men, and ages ranged from eighteen years two months to twenty-two years three months.

Participants were tested individually. They were administered three assessments, and

then asked to complete a self-administered task. Decoding skills were assessed using the Word Attack subtest and the Word Identification subtest of the WRMT-R (Woodcock, 1987), while reading comprehension was assessed using the Passage Comprehension subtest of the WRMT-R. Intelligence was measured using the K-BIT (Kaufman & Kaufman, 1990). The Verbal subscale was used to measure verbal intelligence, which has been used to determine semantic processing, while the Matrices subscale was used to assess nonverbal intelligence, which provides a measure of general matrix reasoning.

The graphophonological-semantic multiple classification task was used to assess GSF. This was the same assessment that was originally developed by Cartwright (2002) for use with elementary children. After a demonstration, participants were asked to sort four sets of twelve cards that each had a printed word into a two-by-two matrix. They were required to sort both by beginning sound and meaning simultaneously. Scores were based on accuracy and speed of sorting. Accuracy scores were determined by correctness of both the sort and verbal justification.

The MRT was the final assessment, and it was a self-administered task used to determine exposure to print. Each participant was asked to complete a questionnaire comprised of forty legitimate magazine titles (Stanovich & Cunningham, 1992) and forty foils (Stanovich & West, 1989). Participants checked titles that they recognized, and scoring was based on the number of correct and incorrect titles checked. The MRT has proved to be a valid test to determine reading frequency (Stanovich & Cunningham, 1992).

Results of this study indicated that hypotheses were correct. First, GSF made a significant contribution to adults reading comprehension skills, above those of semantic

processing, decoding, and general cognitive ability. Second, there was a significant positive correlation between reading experience as measured by the MRT and GSF scores. Finally, GSF made a contribution to reading comprehension independent of the product of decoding and linguistic comprehension, which is the simple view of reading. This study demonstrated that skilled reading requires more than just decoding and linguistic comprehension, even in adults. The ability to flexibly consider both phonological and semantic aspects are needed to be a skills reader.

As a result of the findings of these studies, it is apparent that reading flexibility plays a significant role in reading comprehension. Cartwright et al. (2010) revealed that children gain cognitive flexibility as their age increases, and that performance on reading flexibility tasks can be a predictor of reading comprehension in beginning readers. Furthermore, Cartwright (2006) demonstrated not only that reading flexibility predicts reading comprehension, but that reading flexibility can actually be taught to students, which will in turn increase their abilities to comprehend texts. If reading flexibility can be used to increase the reading comprehension of regular education elementary students, it is possible that reading flexibility could also be used to increase reading comprehension in students with ASD.

**Autism and Reading Comprehension**

The three articles in this section focus on reading skills of students with ASD. Students with ASD tend to have poor oral language skills and language impairments, and this puts them at high-risk for having difficulties with reading (Bishop & Snowling, 2004; Tager-Flusberg & Joseph, 2003). Additionally, students with high-functioning ASD have often been reported to have average or above average decoding skills (Frith & Snowling, 1983; Griswold et al., 2002;

O'Connor and Klein, 2004), while their reading comprehension is often lower than expected for their level of reading ability (Minishew et al., 1994; O'Connor & Hermelin, 1994). The following articles examine the connection between decoding and comprehension skills in students with ASD.

Huemer and Mann (2010) examined decoding and comprehension skills in students with ASD including Pervasive Developmental Disorder—Not Otherwise Specified (PDD-NOS), autism, and Asperger's. They compared assessment results of students with ASD to assessment results of students with dyslexia. Their hypotheses were that oral and written comprehension tasks would indicate greater impairment in the ASD groups than in the dyslexia group, that decoding tasks would show greater impairment in the dyslexia group than in the ASD groups, and that the Asperger's group would consistently outscore both the PDD-NOS group and the autism group in all areas, with the autism group exhibiting the lowest scores. The research method for this study was quantitative.

The study utilized clinical intake data from Lindamood-Bell Learning Processes (LBLP), a network of private learning centers across the U.S., with one center in England. Data was collected from 2001-2006 at all 42 LBLP centers and their five summer sites. The sample included 171 individuals with autism, 94 individuals with Asperger's, 119 individuals with PDD-NOS, and 100 individuals with dyslexia. Students were grouped by their diagnoses, which were reported by their parent or caretaker. All subjects included in the study were verbal and had measureable reading abilities.

The data collected between 2001 and 2006 represented all ASD data collected during that time period, while the data collected on students with dyslexia were a random sample. The

assessment measures used in this study measured students' abilities to decode and comprehend text. A series of standardized tests were used to assess these areas.

The assessments conducted to measure decoding skills included the Woodcock Reading Mastery Test-Revised (Woodcock, 1987) Word Attack subtest, Slosson Oral Reading Test-Revised (Slosson, 1990), Gray Oral Reading Test-Revised, Fourth Edition (GORT-4; Wiederholt, 1991), and Lindamood Auditory Conceptualization Test (Lindamood & Lindamood, 2004). Tests that were used to measure comprehension included the Peabody Picture Vocabulary Test, Third Edition (Dunn & Dunn, 1997), Detroit Tests of Learning Aptitude-Fourth Edition (Hammill, 1991) Word Opposites subtest, Detroit Tests of Learning Aptitude, Second Edition (Banas, 1989) Oral Directions subtest, and GORT-4 Comprehension. Results from each of these tests were collected and analyzed.

Results indicated that, overall, the researchers were correct in their hypotheses. The ASD groups all scored at or above the population mean in the area of decoding, whereas the dyslexia group scored below the mean. The Asperger's group scored the highest, with the autism group and finally the PDD-NOS group trailing behind. In the area of comprehension, both the dyslexia group and the Asperger's group scored above the mean, with the autism and PDD-NOS groups falling below the mean. It was a surprise that the Asperger's group scored above the mean, though the dyslexia group did score higher. An average of the reading scores showed that the Asperger's group outscored the other two ASD groups, with the autism group scoring the lowest. In summary, as predicted, decoding measures were higher among ASD groups compared to the dyslexia group, while comprehension measures were lower among ASD groups in comparison to the dyslexia group. The following article again demonstrates that poor reading comprehension is

often paired with higher decoding skills in students with ASD.

Nation, Clarke, Wright, and Williams (2006) conducted a study investigating reading skills in students with ASD. The researches examined reading skills of children with ASD in the areas of word recognition, nonword decoding, text reading accuracy, and text comprehension. The research method for this study was quantitative.

Forty-one children with ASD were recruited from a Children and Adolescent Mental Health Clinic in the United Kingdom. Children were required to be between the ages of six and fifteen years old, and they had to have measurable language skills.

The researchers sought to determine if there was a correlation between word reading and reading comprehension skills in students with ASD. The researchers administered reading assessments in the areas of reading accuracy, reading comprehension, oral language skills, and nonverbal ability. Three tests were administered to assess reading accuracy and reading comprehensions skills, while two tests were administered to assess oral language skills and nonverbal ability.

To assess reading accuracy the researchers used three reading assessments. *The Graded Nonword Reading Test* (Snowling, Stothard, & McLean, 1996) measured nonword reading skills, the *British Ability Scales* (BAS-II; Elliot, Smith, & McCulloch, 1996) measured word recognition, and the *Neale Analysis of Reading Ability-II* (NARA-II; Neale, 1997) measured children's abilities to read-aloud short passages. To assess reading comprehension, children were given the NARA-II. After reading each passage, children were asked to answer questions.

To assess oral language skills students were administered two assessments. Receptive vocabulary was assessed using the *British Picture Vocabulary Scale-II* (BPVS-II; Dunn, Dunn,

Whetton, & Burley, 1997), while they were given the comprehension subtest from the *Wechsler Intelligence Scale for Children* (WISC-III; Weschler, 1992) to measure oral language comprehension. Finally, to measure nonverbal ability, children were administered the *Block Design* subtest from the WISC-III.

Each participant was individually tested within his or her home or in a quiet room in their schools. The tests were administered in one session that lasted approximately one and a half hours. Children were given breaks when needed.

Nine of the children assessed for this study were unable to read, and were therefore excluded from the study. Of the remaining thirty-two children, mean results overall indicated that levels of word recognition, nonword decoding, and text reading accuracy fell within average ranges, while reading comprehension was impaired. Sixty-five percent of the sample scored at least one standard deviation below the mean in reading comprehension, while thirty-eight percent scored two or more standard deviations below the mean indicating severe deficits in reading comprehension. Students showing deficits in comprehension also showed impairments in vocabulary and oral language comprehension, suggesting that language deficits accompany reading comprehension deficits (Nation et al., 2006).

Of the reading accuracy assessments, students with ASD had the most difficulty with decoding nonwords. Furthermore, of the thirty-two children able to read in the sample, forty-two percent scored one standard deviation below the norms, and twenty-two percent scored two or more standard deviations below the norms in the nonword reading test. This suggests that word recognition and phonological decoding may not be tightly linked in the group of students (Nation et al., 2006). While the previous studies demonstrate that poor comprehension skills are often

paired with higher word recognition skills in students with ASD, the following articles establishes why they may be paying more attention to how words look than to what they mean.

Müller and Nussbeck (2008) conducted a study to determine whether children with Autism Spectrum Disorders (ASD) have a different spontaneous processing style than typically developing children. Specifically, they wanted to determine whether children with ASD would spontaneously look at details or meaning. The researchers hypothesized that children with ASD would prefer a detail-focused processing style as opposed to meaning. The research method for this study was quantitative.

The sample consisted of twenty-five children with high-functioning Autism and Asperger's syndrome and twenty-five typically developing children, each matched based on age, intelligence, and sex. All of the children were able to read and write. Children with ASD were recruited from two Autism therapy centers and one special education facility, and typically developing children were recruited from two local schools.

Participants were tested individually in two sessions. For the first experiment in session one, children were presented a picture and, given a choice of two pictures, asked to determine which one matched with the one they were given. Pictures could either be matched based on details or meaning, but not both. Data was recorded to determine whether children preferred detail or meaning relationships, and it was found that children with ASD chose to match the pictures by detail significantly more often than the typically developing children.

In a second testing session, children were again asked to perform the first experiment. However, this time they needed to name aloud the presented pictures prior to matching. This process was predicted to emphasize the conceptual relations between pictures as opposed to the

detail. The result was that naming the pictures before making a choice did in fact lead most children with ASD to match pictures according to meaning.

A second experiment was conducted following the first experiment in session one. In this experiment, children were given three wooden puzzle pieces and asked to construct an object out of two parts. The puzzle pieces could be matched by either detail or concept, but not both, again demonstrating a preference towards either details or meaning. As in the first experiment in session one, it was found that children with ASD chose to match according to detail significantly more often than the typically developing children.

Results of both the first and second experiment conducted in session one indicated that children with ASD more often spontaneously attend to detail as opposed to meaning than their typically developing peers. Children with ASD chose to match the pictures by detail significantly more often than the typically developing children. However, in the second testing session, when children were asked to name the pictures before choosing them, most of the children with ASD then chose to match according to meaning. This suggested that naming aloud could lead to a shift from focus on details to a focus on meaning. With this in mind, it was concluded by the researchers that while children with ASD seemed to be capable of both detail-based and meaningful processing, they tended to spontaneously focus on details. Considering that decoding words requires a person to pay attention to details, while reading comprehension requires that a person pay attention to meaning, this study helps explain why students with ASD are stronger in their decoding skills than in reading comprehension. This also verifies that reading flexibility strategies may need to be taught in order to assist students with ASD in learning to think about both decoding and reading comprehension simultaneously.

Students with ASD have deficits in reading comprehension that are not the result of poor decoding skills. Huemer and Mann (2010) and Nation et al. (2006) revealed that students with ASD who are verbal and have measurable reading abilities are often average or above average in their abilities to decode words, yet their comprehension skills fall far behind that of their typically developing peers. Furthermore, Müller & Nussbeck (2008) demonstrated that students with ASD tend to spontaneously look at details as opposed to meaning, which may account for their poor comprehension skills, yet they can be prompted to focus on meaning. Research will need to be conducted to determine whether reading flexibility can be increased in students with ASD, and whether this may, in turn, improve reading comprehension. Before conducting research, however, it is imperative to understand how students with ASD think and communicate, and to use this knowledge to determine a best practice method of teaching and assessing students.

**Autism and Visual Supports**

The two articles in this section focus on successful methods of communicating with and assessing students with ASD. People with ASD tend to exhibit a strength in processing visual information, but have difficulty processing auditory information (Grandin, 2011). For this reason, verbal communication is often not effective. Activities, including assessments, that have verbal direction and depend on auditory processing may prove to be difficult for students with ASD. The following research studies demonstrate that using visual supports, such as picture cards and schedules, may provide a way to increase communication, and to increase the validity of assessments and help students with ASD experience success in classroom activities (Breslin & Rudisil, 2011; Ganz & Simpson, 2004).

Augmentative and alternative communication systems (AAC), such as the Picture Exchange Communication System (PECS), are widely used to assist with communication deficits in students with ASD (Mirenda, 2001). Ganz and Simpson (2004) conducted a study to determine whether the introduction of PECS (Frost & Bondy, 1994) would increase the complexity and length of phrases spoken and decrease the non-word vocalizations of students with ASD and students with developmental delays (DD) with characteristics of Autism. PECS is a picture-based augmentative and alternative communication system (AAC) that is frequently used with students with ASD (Mirenda, 2001). The researchers hypothesized that the children involved in the study would increase the complexity and length of phrases spoken while decreasing non-word vocalizations. The research method of this study was quantitative.

Three students from elementary schools located in low-socioeconomic neighborhoods in a large, urban school district were chosen for this study. The students were all between the ages of three and seven, had no prior experience with PECS, had limited functional speech, and were in need of an AAC system. In addition, all of the students were identified by their parents and by school personnel as having little to no functional speech, meaning they were only able to use zero to ten words appropriately in context.

The independent variable consisted of the implementation of the four phases of PECS. The trainer modeling of verbalizations as well as the training guidelines for each phase were kept constant. The dependent variables consisted of the three variables that were being measured during the PECS training sessions. Data was collected concerning whether the child performed the desired response independently or with prompting, the number of intelligible words spoken, and the presence of non-word vocalizations. In addition to the numerical data, videotapes of the

sessions were observed to collect samples of the speech that occurred during trials, to provide evidence of the use of grammar and syntax, and the demonstrate use of vocabulary.

The study was conducted in each participant's elementary school classroom. Training followed the procedures outlined by Frost and Bundy (1994) in the PECS manual. Two to five training sessions took place per week for each student until they had mastered the four phases of PECS.

The intervention consisted of the execution of the four PECS phases. Phase one was Basic Picture Exchange, where the participant was taught to approach an adult, give them a picture, and in turn receive a preferred item. Phase two was Increasing Distance, where participants were taught to retrieve pictures from their communication binders, walk to an adult, and hand them a picture. Phase three was Picture Discrimination, where participants were given choices between preferred and non-preferred items. Ultimately, phase four was Sentences, where participants learned to take a sentence starter (i.e. "I want" picture) and pair it with a picture of a preferred item. Throughout the phases the trainer modeled verbalizations.

Data revealed that all three of the participants made gains in mastery of the PECS system, and demonstrated increases in the number of intelligible words spoken per trial. All of the participants began phase one speaking in zero to one-word utterances, and by the end of phase four, all were using three to four word phrases. This study supports the hypothesis that a picture-based AAC system encourages speech and communication (Ganz & Simpson, 2004). While it was also hypothesized that as intelligible utterances increased non-word vocalizations would decrease, this study demonstrated no clear relationship between spoken words and non-word vocalizations. The research conducted in this study verifies that using visual supports helps

increase communication in students with ASD, while the following study provides evidence that picture cues can assist in gaining best results when administering assessments.

The Test of Gross Motor Development (TGMD-2; Ulrich, 2000) is widely used to assess fundamental motor skills in the United States. However, the verbal commands given during the traditional protocol may be difficult for students with ASD to follow, yielding inaccurate results (Breslin & Rudisill, 2011). For this reason, Breslin and Rudisill (2011) conducted a study to determine the effects of visual supports on the performance of the TGMD-2 for children with ASD. The purpose of their study was to examine the effectiveness of two different visual supports, picture task cards and a picture activity schedule. The researchers hypothesized that participants would perform higher on the TGMD-2 when using the visual supports, and that the picture activity schedule would yield higher scores than the picture task cards. The research method for this study was quantitative.

The data was collected during an extended year summer school program for students with ASD and behavioral disorders located in a small city in the southeastern United States. The sample consisted of twenty-two students with ASD. Sixteen students were male, six were female, five were African American, and seventeen were Caucasian. Ages ranged from 3.5 to 10.92 years old. Sixteen of the participants were diagnosed with Autism, four were diagnosed with PDD-NOS, one was diagnosed with Asperger's syndrome, and one was diagnosed with both Autism and PDD-NOS.

The independent variables were the implementation of three different protocols under which the TGMD-2 was given. Each student was administered the test three times under the three different protocols: traditional protocol, picture task card protocol, and picture activity

schedule protocol. The dependent variables consisted of the gross motor quotient scores of the TGMD-2.

Before testing began, students were acclimated to the testing environment, and the data collectors familiarized the students with the testing procedures. The TGMD-2 was then administered three times over three consecutive days using the different protocols. The order of the protocols was counterbalanced and randomly assigned to ensure that familiarity with the tests did not influence the overall results.

During the traditional protocol, the test was presented using verbal instructions in complete sentences, and students were given a demonstration of the assessment item. In the picture task card protocol, verbal instructions were limited to two or three word commands, a small card with a line drawing showing the assessment item was presented, and a demonstration was given. In the picture activity schedule protocol, verbal instruction were limited to two or three word commands and a line drawing showing the assessment item was presented, as in the picture task card protocol. The difference was that the line drawings were presented in order and attached to a poster, and each line drawing was removed from the poster before the performance of that motor skill. Once it was removed from the board, it was displayed to the student before that motor skill trial as in the picture task card protocol.

Data was collected during each trial using the TGMD-2. The examiners analyzed each individual assessment item for each of the three protocols. Results indicated significant differences between protocols. Both of the visual protocols yielded higher results than the traditional, verbal protocol. However, the picture task card condition produced significantly higher gross motor quotient scores than both the traditional protocol and the picture activity

schedule protocol. The picture activity schedule may have been an unnecessary organizational tool for some students, and may have actually provided too much information for a thirty-minute activity (Breslin & Rudisill, 2011). The researchers concluded that using the picture task card protocol with students with ASD produced the most accurate gross motor quotient scores on the TGMD-2. Minimizing verbal instructions and utilizing a picture task card was beneficial in acquiring the most accurate results for students with ASD.

The two research studies presented in this section reveal the importance of using visuals with students with ASD. While Ganz and Simpson (2004) determined that the use of PECS could help students increase their verbal output, Breslin and Rudisill (2011) determined that using visuals to support assessments may yield the best, most accurate results. Overall, using visuals will increase communication, which will in turn assist in providing best practice assessments and interventions for students with ASD.

**Summary**

Children make many advances throughout childhood in their abilities to think flexibly. During the preschool years they develop the ability to switch back and forth between rules (Baker, Friedman, & Leslie, 2010), and in adolescence they learn to match based on semantic relationships and switch between categorical rules (Blaye, Chevalier, & Paour, 2007). This ability to think semantically will assist students in making meaning of texts, because in order to be flexible readers, students must be able to read and create meaning of texts simultaneously (Cartwright, 2006). Reading flexibility can be a predictor of reading comprehension (Cartwright, Marshall, Dandy, & Isaac, 2010), and Cartwright (2006) demonstrated that reading flexibility could actually be taught to students, which will in turn increase their abilities to

comprehend texts. It has been revealed that students with ASD are often average or above average in their abilities to decode words, however, they have little comprehension (Huemer & Mann, 2010; Nation et al., 2006), however they can be taught to look at meaning as opposed to details using the right strategies (Müller & Nussbeck, 2008). Giving students with ASD the right visual supports could increase communication and assessment successes (Breslin & Rudisill, 2011; Ganz & Simpson, 2004). While more research will need to be conducted, one can now ask if it would be possible to teach students with ASD to become more flexible readers, and in turn increase their reading comprehension. The following chapter discusses the participant, as well as methods used for data collection and procedures of the intervention.

# Chapter Three

## Method

Students with Autism Spectrum Disorder (ASD) typically possess average or above average word identification skills (Frith & Snowling, 1983; Griswold et. Al., 2002; O'Connor and Klein, 2004), while their reading comprehension is frequently lower than expected for their level of word reading ability (Minishew et al., 1994; O'Connor & Hermelin, 1994). In order to be strong, flexible readers, students must be able to read and create meaning of texts simultaneously (Cartwright, 2006). Unfortunately, many students, especially students with ASD (Huemer & Mann, 2010; Nation, Paula, Wright, & Williams, 2006), are able to read the words, but are lacking in their abilities to comprehend. As a result, children with ASD are often not flexible readers. Thus, the focus of this research was to determine whether reading flexibility exercises could be used to increase the reading flexibility in a student with ASD, and whether this in turn would increase her reading comprehension skills.

### Participant

This investigation was conducted as a case study, and therefore consisted of one student. The participant was a female student with ASD in grade four. She was enrolled in a public elementary school in a city in the Midwestern United States. At the time of the study the student was nine years old. The student selected had permission from her parents to participate in the study, and she had good attendance.

As a student with ASD, the subject of the study had very specific learning needs, and she was serviced through the Special Education program at her school. The student was working towards the Wisconsin Extended Grade Band Standards, which are designed for students with

significant disabilities. The standards indicate what students with significant disabilities are expected to know and accomplish academically. In addition, the student had an Individual Education Plan (IEP) outlining her personal educational goals. Due to the nature of her disability, formal testing had never been administered to determine her Intelligence Quotient (IQ) or Academic Achievement scores. The student received the majority of her educational instruction in a Special Education homeroom. She joined her Regular Education peers for physical education class, recess, and on occasion for academics when appropriate. A picture schedule was presented to the student each morning so she could organize her day. Teacher-directed activities were anywhere from five to twenty minutes in length, and were always followed by a sensory break of the subjects choice. Typical sensory breaks included use of an iPad or computer, listening to music, spending time in a quiet, dark space of the room, and playing with stuffed animals or other toys.

Reading instruction for the participant was individualized to meet her specific learning needs. Teacher-led instruction typically began with sight words, followed by short lessons in decoding and/or comprehension. Decoding and sight word recognition skills of the student were much more developed than her comprehension skills. The sight word portion of the lesson consisted of sight word flashcards that were either read from paper flashcards or word flashcards on the computer or Smartboard. The student read anywhere from ten to twenty words to begin each lesson. The student was practicing words from the same lists as her peers, and at the time of the intervention she had mastered the first, second, and third grade lists, and was working from the fourth grade list. When the student had difficulty with a word and when a word was new vocabulary, it was paired with a picture. One time per week the student matched pictures to

words to show understanding. Following sight word practice, the student practiced decoding skills. Computer programs, learning websites, and iPad apps were motivating for the student, and often incorporated into lessons. The student learned sounds and rules through songs and short videos, and then practiced skills using motivating technology. To practice comprehension, the student read short one to three sentence passages and then either had to follow directions to show understanding, or answer multiple choice comprehension questions. The participant tended to learn sight words and decoding strategies very quickly, but progress in comprehension skills was being made very slowly. A reading level had never been determined for the student because she had been unable to be tested in the same way as other students. For this reason it was decided that an intervention intended to improve reading comprehension would be of great benefit to the participant.

**Data Collection**

Data was collected on the participant to determine her Word Identification, Passage Comprehension, and Reading Flexibility Levels. The student was administered pre-assessments in all three areas. The Qualitative Reading Inventory-5 (QRI; Leslie & Caldwell, 2011) word lists (Appendix A) were only administered before the intervention, and were utilized to determine the subjects Word Identification Level. This assessment required the student to read lists of seventeen to twenty words at different grade levels until she reached her frustration level. An independent level entailed reading ninety to one-hundred percent of the words correctly, an instructional level required the student to read seventy to eighty-five percent of the words correctly, and if the student read less than seventy percent of the words correctly she had reached her frustration level. This assessment was administered as presented in the QRI. After this

assessment was completed, the subject was administered QRI passages.

QRI reading passages were administered both before and after the intervention to determine the student's Passage Comprehension Level. Each passage administered first required the student to answer concept questions about a passage topic to determine her familiarity with a topic. The concept questions gave the individual practice in answering questions, and also provided the researcher with information on the student's background knowledge of a particular topic. Next, the student read a passage at a specific grade level, and throughout the reading answered explicit and/or implicit questions about the passage. A Reading Level was determined based on the participant's ability to accurately read a passage and answer comprehension questions.

Independent, instructional, and frustration levels were examined for word identification as well as passage comprehension to find the Reading Level using the QRI. When looking at word identification, a score of ninety-eight to one hundred percent reading accuracy was considered independent, ninety to ninety-seven percent accuracy instructional, and less than ninety percent accuracy was considered a frustration level when reading a passage. With passage comprehension, a score of answering ninety to one hundred percent of questions correctly was considered independent, answering sixty-seven to eighty-nine percent correctly was instructional, and answering less than sixty-seven percent correctly was a frustration level. In order to find a Reading Level, both word identification and passage comprehension must be considered. An independent level was achieved when a student scored at an independent level for both word identification and passage comprehension. An instructional level was achieved when word identification was independent and passage comprehension was instructional, and

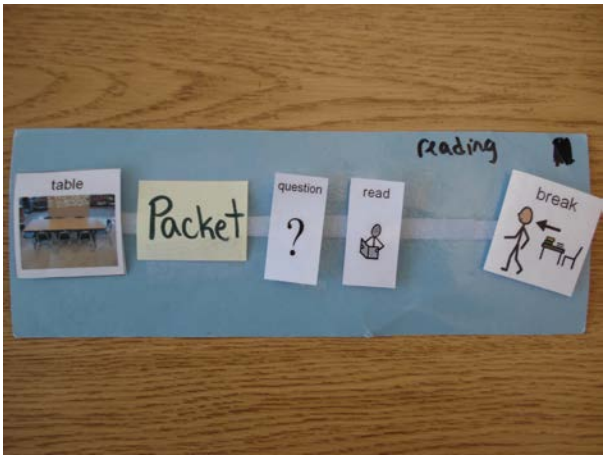
when both word identification and passage comprehension were instructional. A frustration level was achieved when word identification was independent and passage comprehension was at a frustration level, when word identification was instructional and passage comprehension was at a frustration level, and when word identification was at a frustration level and passage comprehension was at an independent, instructional, or frustration level. Unlike the QRI word lists, the reading passages were not administered as presented in the QRI.

The researcher created "autism friendly" QRI passages and questions (Appendix B) in order to obtain the most accurate reading level of the participant's comprehension. Research indicates that using visual supports with students with ASD helps to increase communication (Ganz and Simpson, 2004), and according to Breslin and Rudisill (2011), using visuals to support assessments for students with ASD will yield best results. Hence, a visual schedule was presented to the student before reading each passage (Figure 3.1). The schedule first showed a picture of the table in her classroom to indicate she should go to the table for reading, then pictures to indicate she would be working from a packet, answering questions, and reading, and finally a break card to indicate that once the packet was completed the student could take a sensory break of her choice.

In addition to the schedule, all concept questions and comprehension questions possessed picture answers for the participant to choose from to increase accuracy of results. All of the questions asked were the same as the questions in the original QRI, the student was simply provided with visuals to help assist her in determining answers. In addition to visuals, the QRI passages were also altered to align with the Wisconsin Extended Grade Band Standards as well as the participants IEP reading goals. Reading Standard 2A of the Wisconsin Grade Band

Standards states that students should be able to recall basic facts and/or main ideas from a short paragraph. At a minimal level the paragraph would consist of one simple sentence, at a basic level two simple sentences, at a proficient level three simple sentences, and at an advanced level five simple sentences. Furthermore, the subject's IEP reading goal was to answer multiple choice comprehension questions using words and or pictures, and she was expected to perform at a basic or proficient level. For these reasons, QRI passages were broken up so that she was not expected to read more than five sentences before answering questions about the passage, and answers were presented in a multiple choice format.

*Figure 3.1* QRI Passage Visual Schedule




Once a reading comprehension level was found, the subject was administered a reading flexibility assessment. This assessment was administered both before and after the intervention to determine growth. Cartwright (2010) created a reading flexibility assessment, found in her book *Word Callers*, with which students are assessed on their ability to simultaneously think

about both phonological and semantic aspects of text. In this assessment, the student was asked to sort four sets of twelve word cards into a two-by-two matrix along two dimensions simultaneously. Each card contained a word, and it could be classified both phonologically and semantically. The task was first demonstrated for the student with one set of cards, and she was then expected to sort the remaining four sets independently. Her flexible thinking score was based on accuracy and sorting time. The subject was given one point for correctly sorting the cards, and two points for justifying her sorts with a correct explanation. A Total Accuracy score was found by adding together the points from all four independent sorts. Next, all of the sort times were added together, and then divided by four to find the Average Sort Time. Finally, the Total Accuracy score was divided by the Average Sort Time and multiplied by one hundred to find the Total Flexible Thinking Score. A "Sound Meaning Flexible Thinking Assessment Scoring Sheet" (Figure 3.2) was used to record data. The table in Figure 3.3 was used to compare scores of the participant's performance to that of the performance of students tested in Cartwright's (2010) research. The chart gives the average scores of both strong readers and word callers. Word callers are the students who are able to read and decode words, but unable to think flexibly and determine meaning simultaneously.

*Figure 3.2* Sound Meaning Flexible Thinking Assessment Scoring Sheet (Cartwright, 2010)

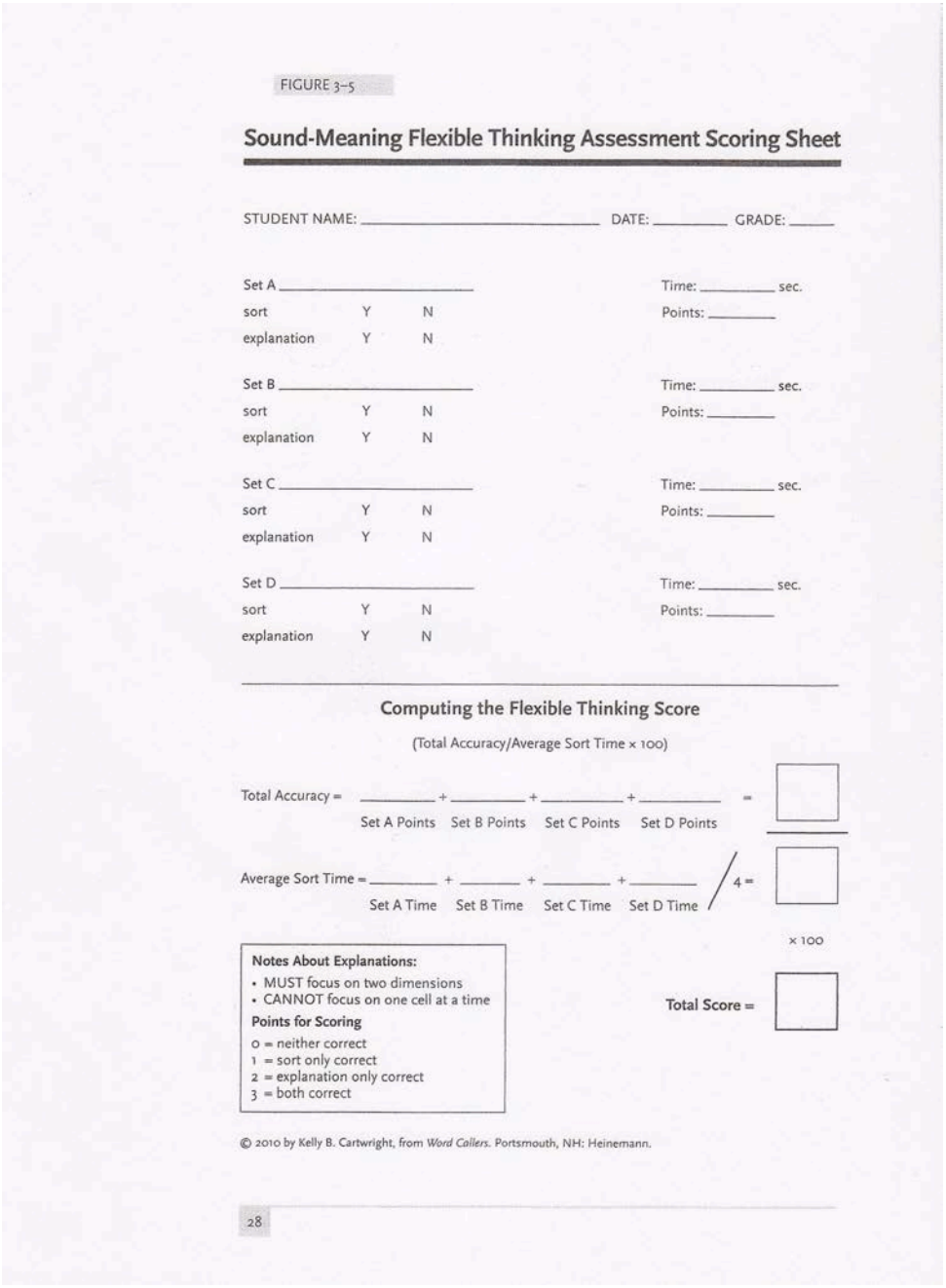


FIGURE 3–5

**Sound-Meaning Flexible Thinking Assessment Scoring Sheet**

STUDENT NAME: _____ DATE: _____ GRADE: _____

Set A _____ Time: _____ sec.
sort Y N Points: _____
explanation Y N

Set B _____ Time: _____ sec.
sort Y N Points: _____
explanation Y N

Set C _____ Time: _____ sec.
sort Y N Points: _____
explanation Y N

Set D _____ Time: _____ sec.
sort Y N Points: _____
explanation Y N

**Computing the Flexible Thinking Score**

(Total Accuracy/Average Sort Time × 100)

Total Accuracy = _____ (Set A Points) + _____ (Set B Points) + _____ (Set C Points) + _____ (Set D Points) = ☐

Average Sort Time = _____ (Set A Time) + _____ (Set B Time) + _____ (Set C Time) + _____ (Set D Time) / 4 = ☐

× 100

**Notes About Explanations:**
- MUST focus on two dimensions
- CANNOT focus on one cell at a time

**Points for Scoring**
0 = neither correct
1 = sort only correct
2 = explanation only correct
3 = both correct

**Total Score =** ☐



28

*Figure 3.3* Sound-Meaning Flexible Thinking Scores across Grades for Strong Readers and Word Callers (Cartwright, 2010)

| | **Strong Readers** | | | **Word Callers** | | |
|---|---|---|---|---|---|---|
| **Grade** | **Average Score** | **Range (Low and High Scores)** | | **Average Score** | **Range (Low and High Scores)** | |
| 1st | 9.80 | 0 | 24.68 | 3.51 | 0 | 7.96 |
| 2nd | 12.38 | 0 | 33.90 | 4.86 | 0 | 28.69 |
| 3rd | 13.17 | 0 | 46.06 | 7.49 | 0 | 20.68 |
| 4th | 16.67 | 0 | 42.91 | 9.08 | 0 | 33.58 |
| 5th | 22.55 | 0 | 53.71 | 12.42 | 2.79 | 19.60 |
| College | 53.69 | 16.77 | 100.25 | 44.69 | 5.49 | 75.85 |

As with the QRI assessment, the researcher altered the reading flexibility assessment to make it "autism friendly" by utilizing visuals. While the participant was expected to independently sort the cards as in the original assessment, she was provided with letter symbol and picture symbol cards to choose from, which the participant used to explain her thinking (Figure 3.4). The letter symbol cards were placed on the matrix to indicate rows or columns that were sorted phonologically, and the picture symbol cards were placed on the matrix to indicate rows or columns that were sorted semantically (Figure 3.5).

*Figure 3.4*


*Figure 3.5*


Once the researcher obtained a word reading level, comprehension level, and reading flexibility level, they began the intervention. Once the intervention was completed, the researcher re-administered the QRI passages to find a comprehension level, as well as the reading flexibility assessment to determine a reading flexibility level.

**Procedures**

The study took place during the participant's regularly scheduled reading class, and took the place of their normal reading instruction. The intervention lasted a total of six weeks, and included thirty sessions which lasted anywhere from five to fifteen minutes in length. The goal of the intervention was to increase the subject's reading comprehension through reading flexibility exercises. The reading flexibility exercises and materials were obtained from the book *Word Callers* (Cartwright, 2010). Materials included five sets of twelve picture cards, nine sets of twelve word cards, and a two by two matrix.

Each lesson followed the same routine. Lessons began with picture reclassification and picture matrix completion, followed by word reclassification and word matrix completion. In the

picture reclassification phase the student was expected to sort a set of picture cards first by "color" (ex. read and yellow) and then by "what" kind of thing was on the cards (ex. fruits and flowers). Next, the researcher placed three cards on the two-by-two matrix so that they were sorted by "color" along one axis and by "what" along the other axis. The student was then given the remaining nine cards in the set and asked to find a picture that completed the matrix. The student then had to explain their reasoning. If they answered correctly, they moved on to the next phase, and if they answered incorrectly, they repeated the matrix. Picture matrix completion was to be repeated until the researcher was confident in the student's understanding of the process. Once this was completed, the reclassification phase and matrix completion phase were repeated with a set of word cards. The only difference when using word cards was that the matrix completion phase had to be completed and explained correctly by the student four times in a row for the lesson to be complete. When the student answered incorrectly, they had to begin the matrix completion phase over.

The intervention consisted of five lessons, each entailing one set of picture cards and one set of word cards. Cartwright's (2010) lessons were each completed in one session during her research. However, due to the nature of the participant's disability, lessons for this intervention were completed over the course of several days to ensure her understanding. The first lesson took a total of eight days to complete with the student. The first picture reclassification sorts were modeled and introduced on day one, then repeated on day two. The picture matrix completion was introduced on day two, and repeated on days three and four. The word reclassification sorts were modeled and introduced on day five, then repeated on day six. The word matrix completion was introduced on day six, and repeated on days seven and eight. The

remaining four lessons were also completed at a pace that ensured success and understanding for the student. Lesson two was completed over a period of four days, lesson three over five days, lesson four over five days, and lesson five over three days. The last five days of the intervention were a review of the matrix completion phase for the five sets of word cards used in the intervention. The intervention lasted a total of thirty days.

As in the assessments, the researcher made the intervention "autism friendly" by utilizing visuals to increase success. First, to begin each session, a visual schedule that lined up the activities for that day was presented to the participant. The schedule always began with a picture of the table that she worked at to indicate that she should go to the table for reading class, and ended with a "break" picture to indicate that once the activities were completed she would get to take a sensory break. The rest of the visuals were changed each day to reflect that days activities. If the student was expected to complete the picture reclassification phase, she was presented with a "sort by color" and a "sort by what" picture (Figure 3.6). If she was going to complete the word reclassification phase, she was presented with a "sort by sound" and "sort by meaning" picture on the schedule (Figure 3.7). When the student was expected to complete a matrix, she was presented with a picture of the matrix, and up to four pieces of tape with the numbers one through four on them to indicate the number of times she was to complete the matrix (Figure 3.8). In addition to the visual schedule, the student required visuals to explain her reasoning in both the reclassification and matrix phases of the intervention.

*Figure 3.6* Visual Schedule to Sort by Color and What

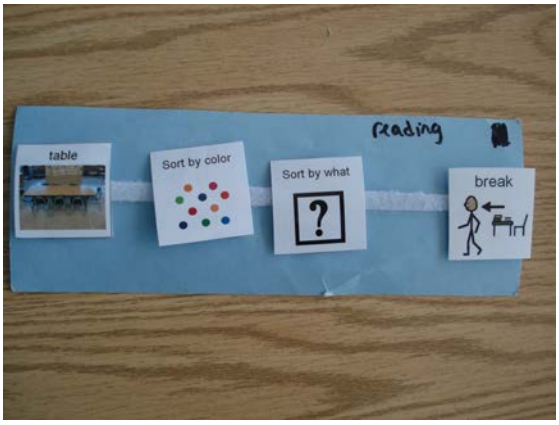



*Figure 3.7* Visual Schedule to Sort by Sound and Meaning

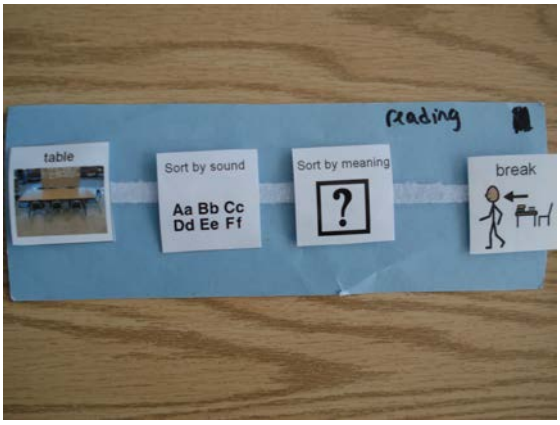
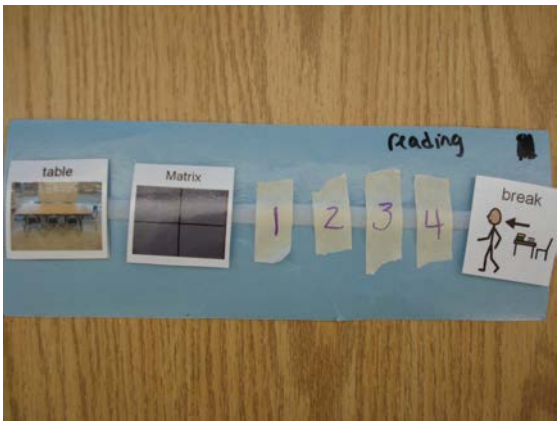



*Figure 3.8* Matrix Completion Visual Schedule




To assist with the reclassification and matrix phases of the intervention, the participant was presented with visuals to support each category. During the reclassification phase, when sorting by "color," she was shown a visual to indicate that she should sort by color, and then once she sorted she was given visuals for the colors so she could label the columns (Figure 3.9). When sorting by "what," she followed the same process, and was given visuals for each category to assist her in labeling (Figure 3.10). The same process was followed when she sorted by sound

and meaning, and she was presented with visuals indicating the beginning sounds of the words (Figure 3.11) and the categories for meaning (Figure 3.12). The same visuals were then used for the matrix completion phases. When completing a picture card matrix, the student used the "color" and "what" category visuals to indicate her explanation. She was given all of the "color" and "what" visuals to choose from, and she had to fill in to explain her thinking (Figure 3.13). Likewise, when completing a word card matrix, the student used the "sound" and "meaning" category visuals to indicate her explanation, as in the assessment (Figures 3.4 and 3.5). Through the use of the visuals, the individual was able to successfully explain her thought processes. The picture and/or word cards used, as well as the activities of each session and notes about accomplishments, were all recorded on a record sheet provided by Cartwright (2010).

*Figure 3.9* Sort by Color


*Figure 3.10* Sort by What

*Figure 3.11* Sort by Sound

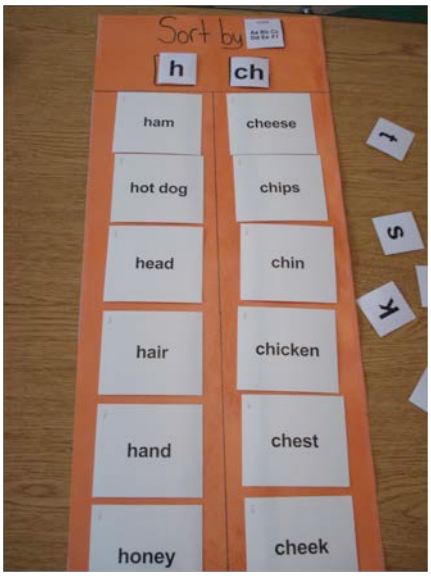



*Figure 3.12* Sort by Meaning


*Figure 3.13*



**Summary**

Research in the area of reading and students with ASD indicates that while decoding skills are often average or above average, comprehension tends to be below average. In addition,

an increase in reading flexibility skills can lead to an increase in reading comprehension. Based on the research in these areas, this six-week intervention sought to look closely at the relationship between reading flexibility and reading comprehension in students with ASD. A case study was conducted with one fourth-grade student to determine if reading flexibility exercises could increase reading flexibility skills, and in turn increase reading comprehension skills. Pre and post-assessments were conducted using QRI word lists, QRI reading passages, and Cartwright's (2010) reading flexibility assessment. The results of the procedures described as well as the data collected are discussed in the following chapter.

*Figure 3.14* Session Record Sheet

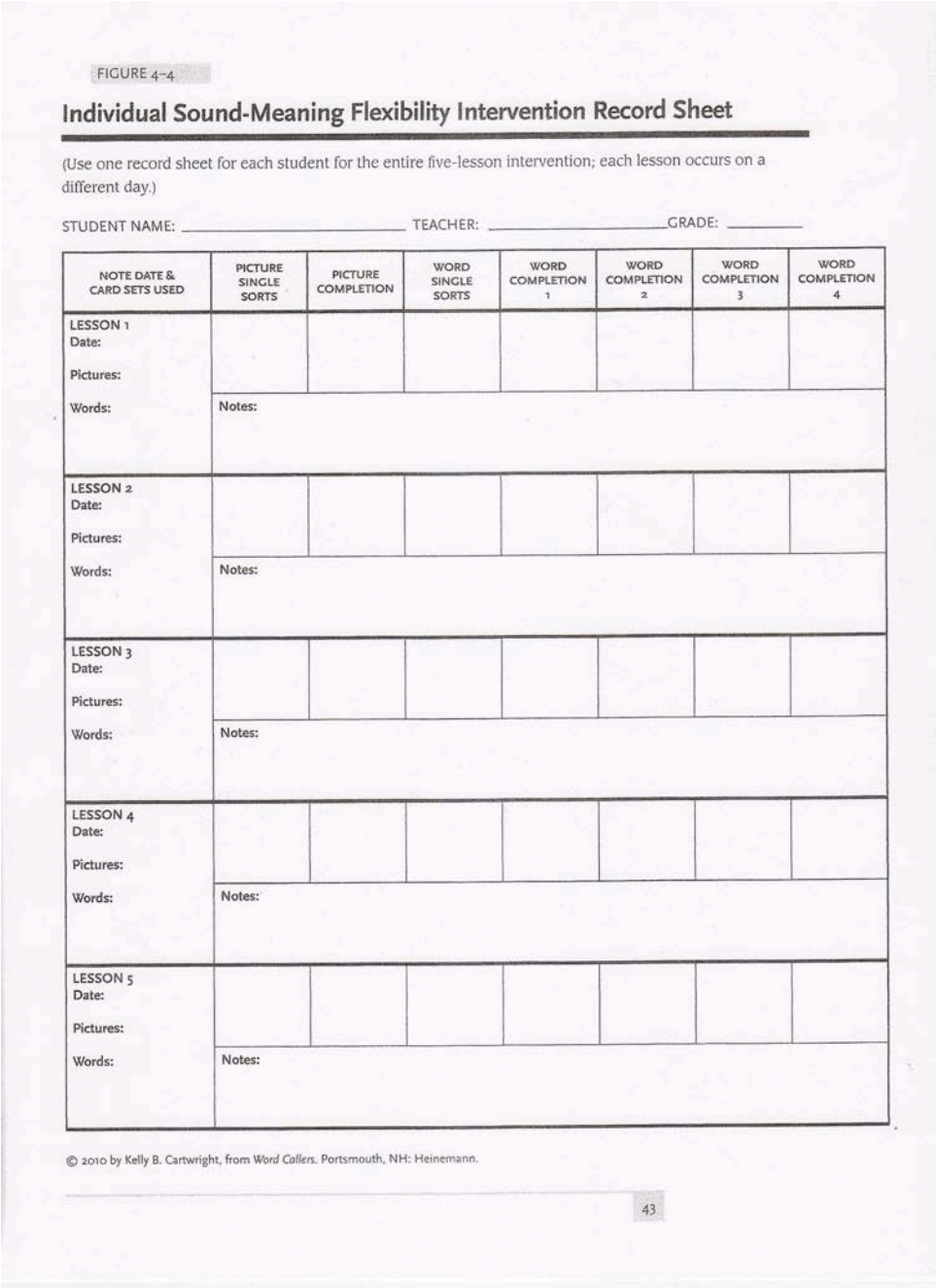


FIGURE 4–4

**Individual Sound-Meaning Flexibility Intervention Record Sheet**

(Use one record sheet for each student for the entire five-lesson intervention; each lesson occurs on a different day.)

STUDENT NAME: _____ TEACHER: _____ GRADE: _____

| NOTE DATE & CARD SETS USED | PICTURE SINGLE SORTS | PICTURE COMPLETION | WORD SINGLE SORTS | WORD COMPLETION 1 | WORD COMPLETION 2 | WORD COMPLETION 3 | WORD COMPLETION 4 |
|---|---|---|---|---|---|---|---|
| LESSON 1<br>Date:<br>Pictures:<br>Words: | | | | | | | |
| | Notes: | | | | | | |
| LESSON 2<br>Date:<br>Pictures:<br>Words: | | | | | | | |
| | Notes: | | | | | | |
| LESSON 3<br>Date:<br>Pictures:<br>Words: | | | | | | | |
| | Notes: | | | | | | |
| LESSON 4<br>Date:<br>Pictures:<br>Words: | | | | | | | |
| | Notes: | | | | | | |
| LESSON 5<br>Date:<br>Pictures:<br>Words: | | | | | | | |
| | Notes: | | | | | | |

# Chapter Four

## Results

This study examined the effects of reading flexibility exercises on the reading flexibility and reading comprehension skills of a student with Autism Spectrum Disorder (ASD). The researcher administered the Qualitative Reading Inventory-5 (QRI; Leslie & Caldwell, 2011) as well as a reading flexibility assessment (Cartwright, 2010). QRI word lists were administered before the intervention began to determine a Word Identification Level, and QRI Passages were administered both before and after the six-week intervention to determine growth in her Passage Comprehension Level. In addition, the researcher determined the participants Reading Flexibility Level by administering the reading flexibility assessment both before and after the intervention to determine growth.

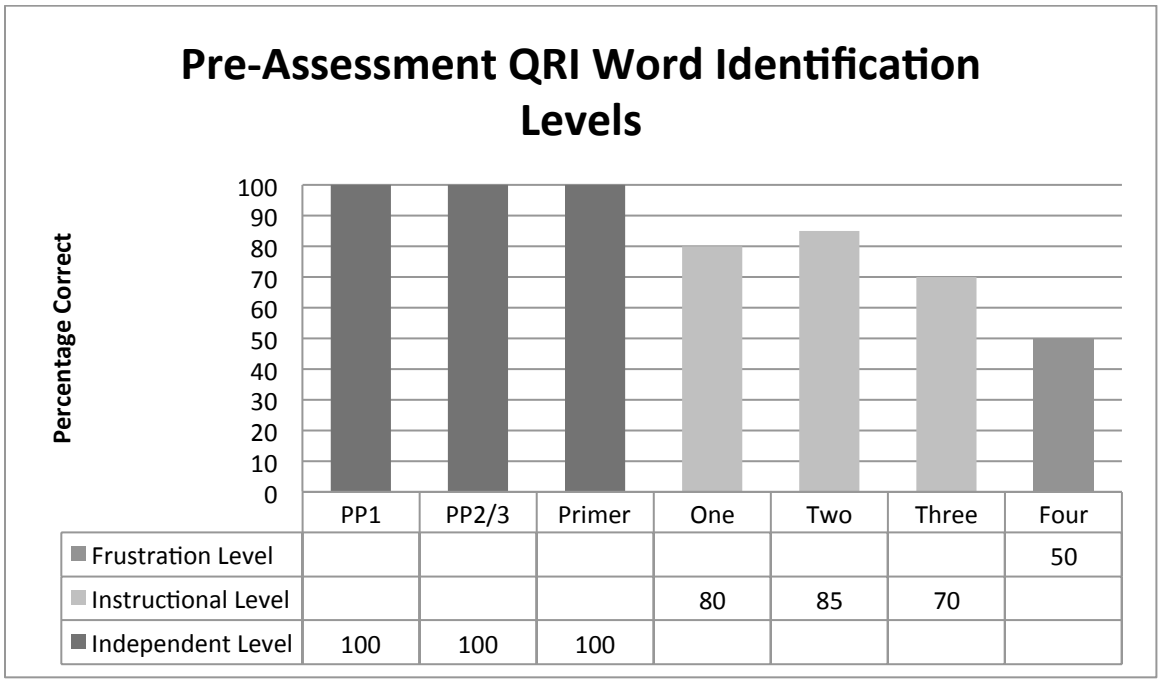
### Word Identification Level

The participant was administered the QRI word lists with the purpose of determining her word reading ability to later be compared with her comprehension skills. Figure 4.1 presents how she scored on each word list by the percent correct, and additionally displays whether the list was at her independent, instructional, or frustration level.

The participant scored at the independent level for the Pre-Primer One, Pre-Primer Two/Three, and Primer lists with sores of one hundred percent words read correctly. She scored at the instructional level for the Grade One, Two, and Three lists with scores of eighty, eighty-five, and seventy percent words read correctly respectively. The Grade Four list was at the participant's frustration level, where she received a score of fifty percent words read correctly. Therefore, the participants instructional Word Identification Level was at a third grade level.

The researcher determined that, as a fourth grade student, the student was approximately one grade level behind her same-age peers in her word-reading ability. Once a Word Identification Level was found, the researcher administered the QRI passages.

*Figure 4.1* QRI Word Identification Levels

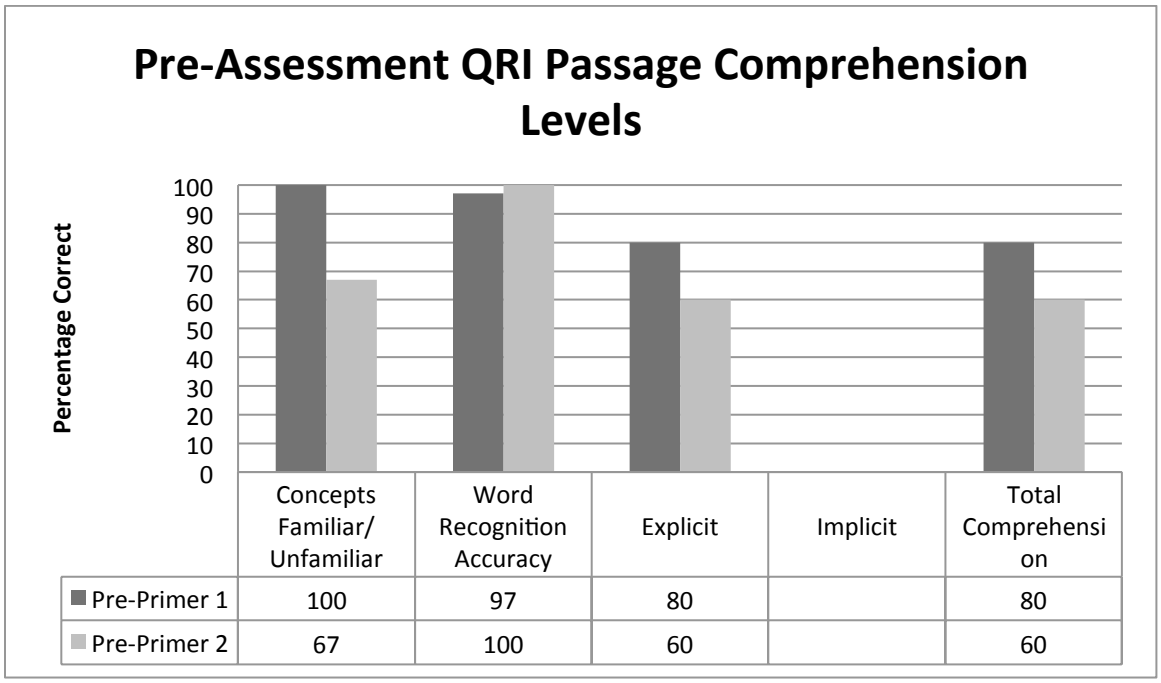



**Passage Comprehension Level**

The participant was administered the QRI reading passages to determine her Passage Comprehension Level. QRI Passages were delivered both before and after the six-week intervention to determine growth made through the intervention. Figure 4.2 presents how the subject scored during the pre-assessment by the percent correct in the areas of familiarity of concepts, word recognition accuracy, explicit comprehension questions, implicit comprehension

questions, and total comprehension score.

*Figure 4.2*



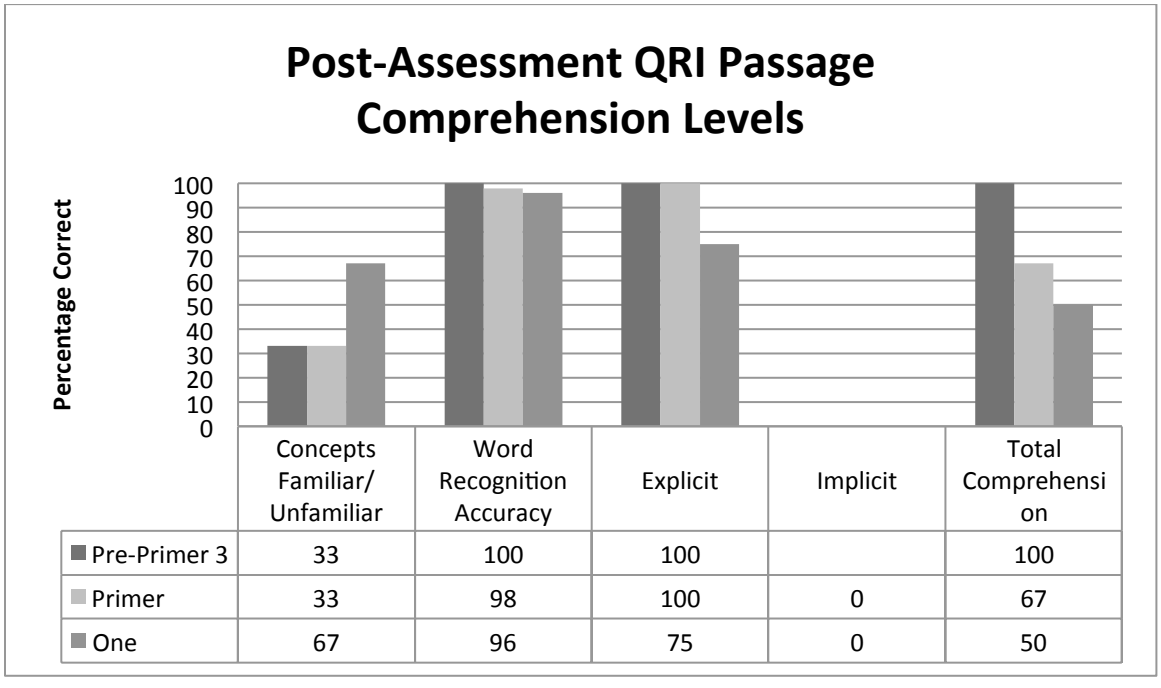

The pre-assessment consisted of two passages read, and an independent reading level was not discovered. The subject's instructional level was found to be pre-primer one. She answered the concept questions with one hundred percent accuracy, indicating she was familiar with the passage topic. The subject's word recognition accuracy was ninety-seven percent, scoring in the independent range for word identification, and she answered eighty percent of comprehension questions correctly, all of the questions explicit, scoring in the instructional range. There were no implicit comprehension questions to accompany this passage.

The subject scored at a frustration reading level for the pre-primer two passage. She

answered the concept questions with sixty-seven percent accuracy, indicating she was unfamiliar with the passage topic. The student's word recognition accuracy was one hundred percent, at the independent level, and she answered comprehension questions, all of them explicit, with sixty percent accuracy, scoring at the frustration level for passage comprehension. Again, there were no implicit questions to accompany this passage.

After the implementation of the six-week intervention, a post-assessment was administered. Figure 4.3 presents how the subject scored during the post-assessment by the percent correct in the areas of familiarity of concepts, word recognition accuracy, explicit comprehension questions, implicit comprehension questions, and total comprehension score.

*Figure 4.3*




| | Concepts Familiar/ Unfamiliar | Word Recognition Accuracy | Explicit | Implicit | Total Comprehension |
|---|---|---|---|---|---|
| Pre-Primer 3 | 33 | 100 | 100 | | 100 |
| Primer | 33 | 98 | 100 | 0 | 67 |
| One | 67 | 96 | 75 | 0 | 50 |

During the post-assessment three passages were read, and an independent, instructional, and frustration level were discovered for the participant. Her independent level was found to be pre-primer three. She answered the concept questions with thirty-three percent accuracy, indicating she was unfamiliar with the passage topic. The subject's word recognition accuracy was one hundred percent, scoring in the independent range for word identification, and she answered one hundred percent of comprehension questions correctly, all of the questions explicit, scoring in the independent range as well. No implicit questions were asked with this passage.

The subject's reading level for the primer passage was instructional. She answered the concept questions with thirty-three percent accuracy, indicating she was unfamiliar with the passage topic. The student's word recognition accuracy was ninety-eight percent, at the independent level. She answered explicit comprehension questions with one hundred percent accuracy, and implicit questions with zero percent accuracy, giving her a total comprehension level of sixty-seven percent. This put her in the instructional range for passage comprehension.

The student's reading level for the grade one passage was frustration. She answered the concept questions with sixty-seven percent accuracy, indicating she was unfamiliar with the passage topic. The student's word recognition accuracy was ninety-six percent, at the instructional level. She answered explicit comprehension questions with seventy-five percent accuracy, and implicit questions with zero percent accuracy, giving her a total comprehension level of fifty percent. This put her in the frustration range for passage comprehension.

**Reading Flexibility Level**

The participant was administered the reading flexibility assessment to determine her

Reading Flexibility Level. The test was delivered as both a pre-assessment and as a post-assessment to determine growth made through the intervention. Figure 4.4 presents how the subject scored during the pre-assessment.

The pre-assessment required the student to complete four reading flexibility exercises. Results of each exercise were recorded as seen in Figure 4.4. Her final score was based on how quickly she was able to sort the cards, and whether the sort and/or explanation were correct. The Total Score was compared to the chart in Figure 3.3, which gave the average scores in Cartwright's (2010) research for strong readers and word callers in first through fifth grade and college. The average score for a fourth grade strong reader was 16.67, and the average score for a fourth grade word caller was 9.08. In the pre-assessment the participant was unable to sort or explain any of the four exercises, and she received a Total Score of zero. This put her below the average in both categories. She was rated as a word caller because she could read the words, but was unable to think flexibly by determining meaning simultaneously.

*Figure 4.4* Pre-Assessment Sound-Meaning Flexible Thinking Assessment Scoring Sheet

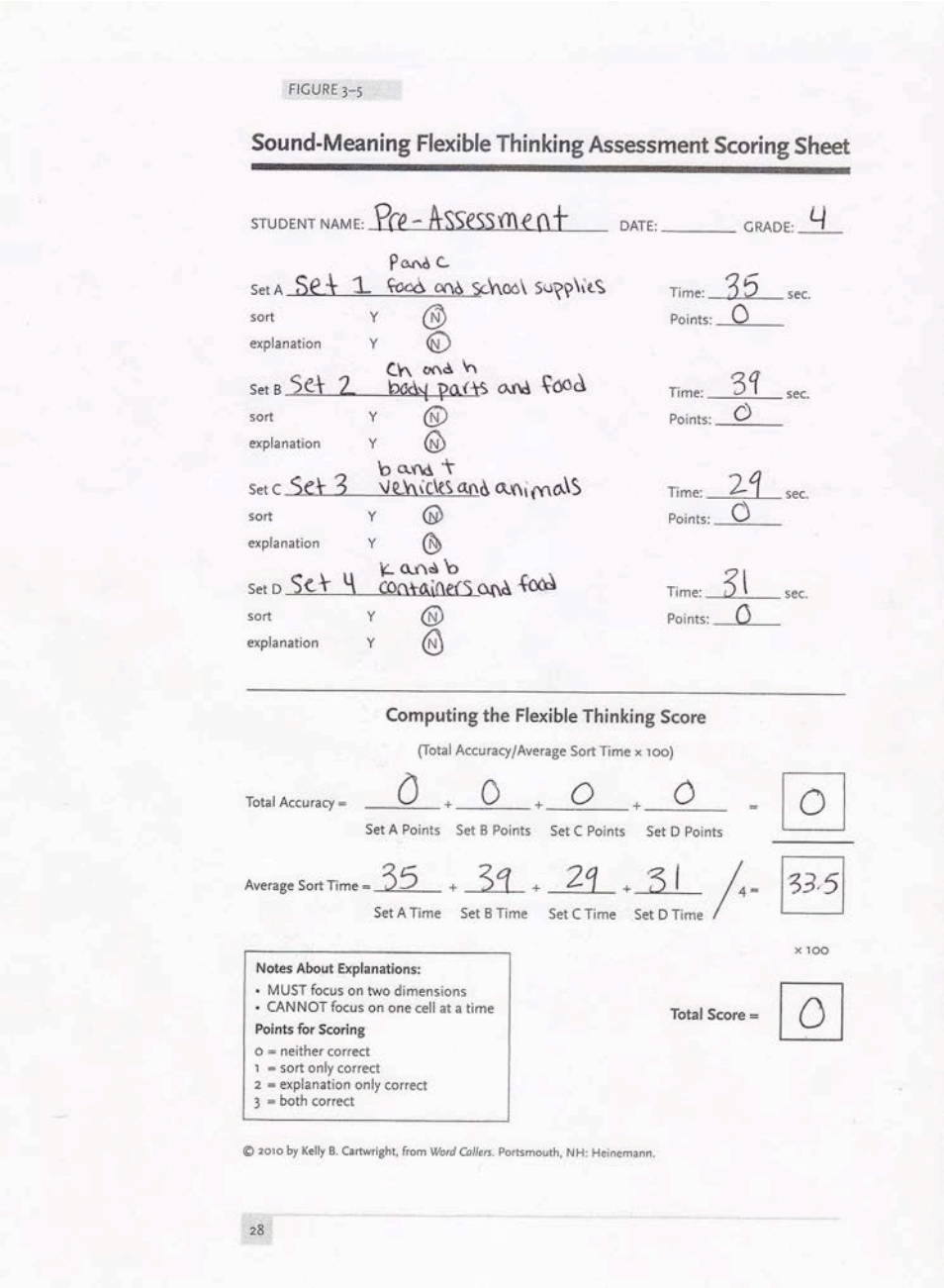


FIGURE 3–5

**Sound-Meaning Flexible Thinking Assessment Scoring Sheet**

STUDENT NAME: Pre-Assessment DATE: _____ GRADE: 4

Set A Set 1 P and C food and school supplies — Time: 35 sec. — Points: 0
sort Y (N)
explanation Y (N)

Set B Set 2 Ch and h body parts and food — Time: 39 sec. — Points: 0
sort Y (N)
explanation Y (N)

Set C Set 3 b and t vehicles and animals — Time: 29 sec. — Points: 0
sort Y (N)
explanation Y (N)

Set D Set 4 k and b containers and food — Time: 31 sec. — Points: 0
sort Y (N)
explanation Y (N)

**Computing the Flexible Thinking Score**

(Total Accuracy/Average Sort Time × 100)

Total Accuracy = 0 (Set A Points) + 0 (Set B Points) + 0 (Set C Points) + 0 (Set D Points) = 0

Average Sort Time = 35 (Set A Time) + 39 (Set B Time) + 29 (Set C Time) + 31 (Set D Time) / 4 = 33.5

× 100

**Notes About Explanations:**
- MUST focus on two dimensions
- CANNOT focus on one cell at a time

**Points for Scoring**
0 = neither correct
1 = sort only correct
2 = explanation only correct
3 = both correct

Total Score = 0



28

The post-assessment was exactly the same as the pre-assessment, except four new reading flexibility exercises were presented to the student. Results of each exercise were

recorded as seen in Figure 4.5.

*Figure 4.5* Post-Assessment Sound-Meaning Flexible Thinking Assessment Scoring Sheet

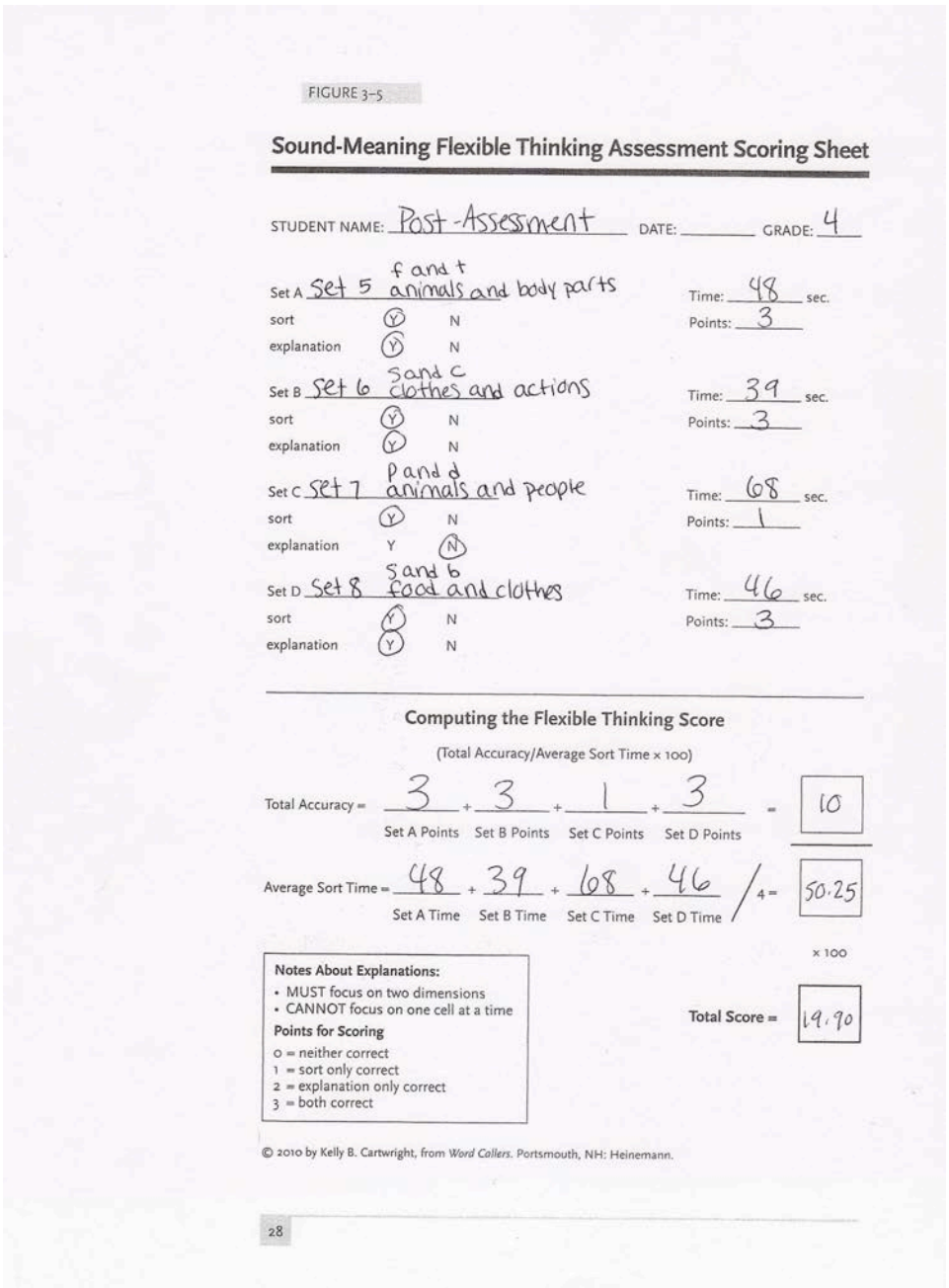


FIGURE 3–5

**Sound-Meaning Flexible Thinking Assessment Scoring Sheet**

STUDENT NAME: Post-Assessment DATE: _____ GRADE: 4

Set A Set 5 f and t animals and body parts — Time: 48 sec.
sort (Y) N — Points: 3
explanation (Y) N

Set B Set 6 s and c clothes and actions — Time: 39 sec.
sort (Y) N — Points: 3
explanation (Y) N

Set C Set 7 p and d animals and people — Time: 68 sec.
sort (Y) N — Points: 1
explanation Y (N)

Set D Set 8 s and b food and clothes — Time: 46 sec.
sort (Y) N — Points: 3
explanation (Y) N

**Computing the Flexible Thinking Score**

(Total Accuracy/Average Sort Time x 100)

Total Accuracy = 3 (Set A Points) + 3 (Set B Points) + 1 (Set C Points) + 3 (Set D Points) = 10

Average Sort Time = 48 (Set A Time) + 39 (Set B Time) + 68 (Set C Time) + 46 (Set D Time) / 4 = 50.25

x 100

**Notes About Explanations:**
- MUST focus on two dimensions
- CANNOT focus on one cell at a time

**Points for Scoring**
0 = neither correct
1 = sort only correct
2 = explanation only correct
3 = both correct

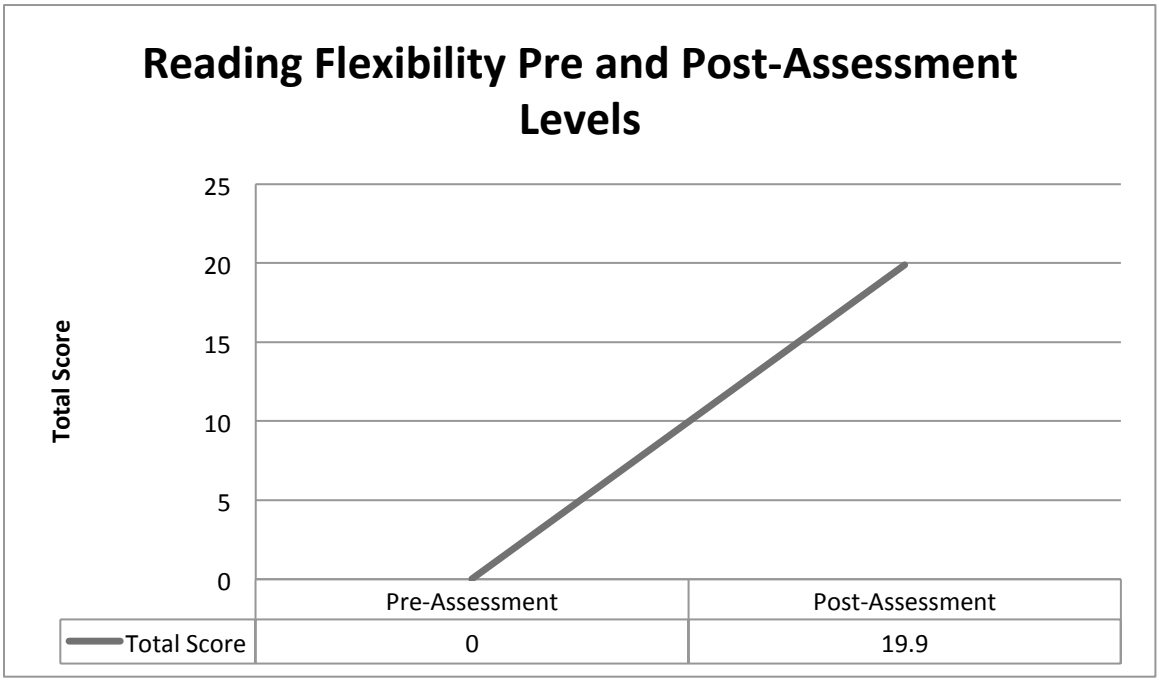
**Total Score =** 19.90



28

Again, the student's final score was based on how quickly she was able to sort the cards, and whether the sort and/or explanation were correct. The Total Score was compared to the chart in Figure 3.3. The average score for a fourth grade strong reader was 16.67, and the average score for a fourth grade word caller was 9.08. In the post-assessment the participant sorted all cards correctly, and provided the correct explanation using picture cards in three of the four exercises. Based on this information as well as the average time it took for her to complete the tasks, she received a Total Score of 19.90. This put her above average for her age group in both categories. She was able to read the words, as well as think flexibly by determining meaning simultaneously. Figure 4.6 depicts the participants reading flexibility gains from the pre to post assessments.

*Figure 4.6*



**Summary**

The data collected in this study focused on word identification, passage comprehension, and reading flexibility. The participant's Word Identification Level score was instructional for the third grade word list. Her Passage Comprehension Level score was instructional for the pre-primer one passage before the intervention was implemented, and instructional at the primer level after the six-week intervention was completed. The participant was not able to answer any implicit questions correctly. While a discrepancy continued to exist between her Word Identification and Passage Comprehension Levels, her Passage Comprehension Level did increase after the intervention. The student's Reading Flexibility Level increased from zero before the intervention, to 19.90 after the intervention. Interpretations of the data as well as implications of the study are discussed in the following chapter.

# Chapter Five

# Conclusions

Utilizing reading flexibility exercises was an effective method for increasing both reading flexibility and comprehension in students with Autism Spectrum Disorder (ASD). Based upon the assessments administered, the participant in this study made gains in both her reading flexibility and reading comprehension skills.

## Connections to State Standards

In designing this study, it was important to consider state standards as well as the goals of the participant. The Common Core State Standards, which support educators by giving them a guideline for teaching core concepts in a way that allows students to master them, place literacy as a focus in all academic areas, with comprehension as its objective. Likewise, the Wisconsin Extended Grade Band Standards, which assist educators in teaching students with significant disabilities by indicating what students are expected to know and accomplish academically at all levels of learning, also place comprehension of literacy as a focus in all areas. Learning to read and understand text is critical to learning in all subject areas, and literacy skills are essential for every student. The participant possessed an Individual Education Plan (IEP) outlining her personal educational goals, which were based upon the Wisconsin Extended Grade Band Standards, and this plan was vital in determining the design of this specific intervention.

## Connections to Existing Research

In addition to the state standards and the student's IEP, recent research in the areas of cognitive and reading flexibility, as well as reading comprehension and the use of visual supports in students with ASD, were explored prior to the study's design and implementation. The ability

to read flexibly begins with the ability to think flexibly. Children develop the ability to think flexibly with age, beginning in the preschool years (Baker, Friedman, & Leslie, 2010; Kloo & Perner, 2005). It is in the later elementary school grades that children begin to develop the ability to distinguish semantic relationships and categorize based on meaning (Blaye, Chevalier, & Paour, 2007). This is why children are often able to read words before they can understand passages. As children gain the ability to think flexibly about the world throughout the elementary school years, they also acquire the ability to think flexibly about the phonological and semantic components of text.

Research indicates a strong relationship between reading flexibility and reading comprehension. Cartwright, Marshall, Dandy, & Isaac (2010) found that reading flexibility is a predictor of reading comprehension. This is apparent when looking at the participant's assessment results. In the pre-assessment her instructional reading level was pre-primer one and her reading flexibility score was zero, while in the post-assessment her instructional reading level was primer and her reading flexibility score was 19.90. As her reading flexibility increased, so did her reading comprehension. Cartwright (2002; 2006; 2007; 2010) has been a forerunner in recent reading flexibility research. Her research has established that reading flexibility makes a unique contribution to reading comprehension, and that children may be taught to think more flexibly through reading flexibility exercises to increase their reading comprehension. Cartwright's reading flexibility exercises were used for this intervention, and the evidence supports that an increase in reading flexibility resulted in an increase in reading comprehension. Additionally, when looking at this research it is essential that that the nature of the participant and her reading skills be studied.

Studies have shown that, like the participant of this study, children with ASD tend to have poor oral language skills (Bishop & Snowling, 2004) and language impairments (Tager-Flusberg & Joseph, 2003), which put them at high-risk for having difficulties with reading. More specifically, students with ASD tend to have the ability to read and decode words, yet have poor reading comprehension skills (Huemer & Mann, 2010; Nation, Clarke, Wright, & Williams, 2006). The evidence in this study clearly indicates a discrepancy between the participant's word reading ability and her passage comprehension level. While she was able to read words at a third grade level, she only comprehended passages at a pre-primer one level according to the pre-assessment. This discrepancy may be explained by her inability to think flexibly. Students with ASD tend to spontaneously look at details as opposed to meaning (Müller & Nussbeck, 2008). This means they are only looking at information in one way, and flexibility requires a person to have the ability to look at something in more than one way. Before the intervention, when the participant looked at words, she was able to read the word, but not make meaning of it without prompting. After the intervention was implemented, she was able to both read and find meaning in words without the support of prompting. Reading flexibility was a skill that had to be taught to this student. Another aspect of the student's disability that required research was her need for visuals.

People with ASD exhibit a strength in processing visual information, and have difficulty processing auditory information (Grandin, 2011). For this reason, activities, including assessments, that have verbal directions and depend on auditory processing may prove difficult for students with ASD. Using visual supports, such as picture cards and schedules, in place of spoken directions and responses, may provide a way to increase the validity of assessments, and

help students with ASD experience success in classroom activities (Breslin & Rudisill, 2011). In addition, augmentative and alternative communication systems (AAC), such as the Picture Exchange System (PECS), are widely used and very effective in assisting with communication deficits (Mirenda, 2011), and visual supports have actually been shown to increase communication in students with ASD (Ganz & Simpson, 2004). This is why the reading flexibility exercises, along with the assessments used during the intervention, were altered to fit the learning needs of the student. When administering the assessments and during the intervention, pictures were provided. Schedules were used to assist with predictability and transitions, picture cards to initiate directions, and visuals to help the student answer questions and explain her choices. Research was imperative to both the validity of the assessments and the success of the intervention results.

**Explanation of Results**

Based on comparisons of pre and post-assessments, the participant made positive gains in the areas of reading flexibility and reading comprehension. The Qualitative Reading Inventory-5 (QRI; Leslie & Caldwell, 2011) passages were administered as a pre and post-assessment to determine a Passage Comprehension Level for the student both before and after the six-week intervention was implemented, and the QRI word lists were administered as a pre-assessment to establish a Word Identification Level. Before the intervention was implemented, a large discrepancy was found between the student's Word Identification Level and Passage Comprehension Level. While she was able to instructionally read words at a third grade level, she comprehended at a pre-primer one level. The student's word reading ability far outweighed her comprehension. This discrepancy was the basis for the intervention.

The post-assessment revealed an increase in the participant's Passage Comprehension Level. However, even with this increase, there continued to exist a large discrepancy between her word reading and comprehension abilities. Following the intervention, the student's instructional Passage Comprehension Level was found to be at a primer level. When paired with a third grade word reading level, there were three grade levels between her word reading and comprehension abilities. This is a sizeable difference, and still indicates a discrepancy between word reading and comprehension abilities. However, it is important to look more closely at the comprehension questions. With the pre-primer one, pre-primer two, and pre-primer three passages, only explicit questions were asked during testing. Beginning with the primer reading passage of the QRI, both explicit and implicit questions were a part of the assessment. Considering the knowledge that students with ASD tend to have language impairments (Tager-Flusberg & Joseph, 2003) and that they are better able to understand details as opposed to meaning (Müller & Nussbeck, 2008), it would make sense that the participant demonstrated aptitude when answering explicit questions, and a weakness in answering implicit questions. During the post-assessment the student answered zero implicit questions correctly, yet she answered one hundred percent of explicit questions correctly for the primer passage and seventy-five percent of explicit questions correctly for the grade one passage. When considering both explicit and implicit questions, the primer and first grade passages were at an instructional and frustration level respectively. However, when only explicit questions are considered, these passages were at her independent and instructional levels. While reading flexibility exercises were able to increase the student's comprehension of the written text, they were not able to increase her ability to make inferences.

**Strengths**

Reflection upon the research completed in this study revealed a number of strengths. First, use of visuals throughout the assessments and intervention increased the participant's ability to communicate and transition through activities with ease. As research indicated, visuals are necessary when working with students with ASD. Therefore, each component of the sessions included some type of visuals to increase the effectiveness. Visual schedules, picture options when answering QRI passage questions, and pictures to assist in explaining answers during the flexibility exercises all increased the effectiveness and validity of the study.

An additional strength of the study was that the participant was at ease during sessions due to her relationship with the researcher and the predictable routine presented each day. Every student with ASD is different, and in my experiences it takes time for those working with a student to gain trust and to understand their specific needs. The researcher had worked closely with the student previous to the study, so trust had already been achieved, which allowed for the everyday reading routine to be disrupted and replaced with the intervention. Moreover, the student responded very well to the visual schedule, and she knew exactly what to expect based upon the visuals included on each day's schedule. Every reading class began with proceeding to the table, and ended with a break of the participant's choice. Each component of the session was predictable based upon the pictures on the schedule. For this reason, the student never hesitated to begin reading class, and she was always at ease throughout sessions. This allowed for maximum progress to be made during each session.

**Limitations**

While the strengths of this study contributed to the positive outcomes, there were a

number of limitations. First and foremost, this was a case study consisting of only one student. For this reason, the study cannot be generalized and applied to students with ASD as a whole. While the researcher believes that the strategies implemented were research based best practice and would initiate similar results when used with other students with ASD, there is no way to prove this until the assessments and intervention are exercised with a larger population.

Additionally, the QRI passages presented limitations. Firstly, the participant was not familiar with all of the pictures that were options as a part of the QRI passages. After assessments were administered, the researcher questioned the student about why incorrect answers were chosen. In some instances the researcher found that the participant chose answers simply because she was able to make meaning of that particular picture, not because she felt that was a correct answer. This limited the validity of the assessment because the picture cues did not aide in communication when the student was unfamiliar with the pictures. Even if the questions were understood, incorrect answers may have been chosen simply because pictures were unclear. Furthermore, only narrative texts were used in this study, meaning the reading level established reflected only upon the participant's ability to understand narrative texts, and did not reveal any information about her ability to comprehend expository texts. This again influenced the strength of the study because the reading level was not based upon all types of passages. A final limitation was that while some passage questions consisted of only explicit questions, other passages questions employed both explicit and implicit questions. This put the participant at an unfair disadvantage. Even when she proved that she understood a story based on her ability to answer explicit questions, her total comprehension was compromised because she was unable to make inferences.

**Recommendations for Future Research**

Recommendations for future research are based upon the limitations of the study. While the results of this case study were encouraging and a sound starting point for reading flexibility research in students with ASD, further research must be conducted with a larger, more diverse sample to determine whether the assessments and the intervention are truly successful and valid strategies. First and foremost, the assessments must be administered and the intervention carried out with additional students with ASD. As the name implies, autism is a spectrum. It is imperative that this research is done with students across the spectrum, and with a large sample group, to determine if it is an effective intervention for other students with ASD who are strong word readers but lack in comprehension skills.

In addition, it would be beneficial to assure that students have a firm understanding of the meaning of the pictures used as a part of the QRI passages and flexibility exercises before administered. Pre-teaching the QRI pictures so that students have the background knowledge to understand their meaning would ensure that answers ensure that students are choosing the best answer based upon the questions asked. Pre-teaching the pictures used as part of the flexibility exercises would ensure that students understand the categories, and would allow them to make educated decisions. If students are not taught the pictures before the assessments and exercises, the teacher has no way of knowing if students have deficits in comprehension, or if they simply do not know the vocabulary,

Finally, remaining QRI passages and questions need to continue to be adapted for future testing so that students with ASD at all levels can be assessed. Additionally, because this study only considered narrative text when establishing a reading level, it would be advantageous to

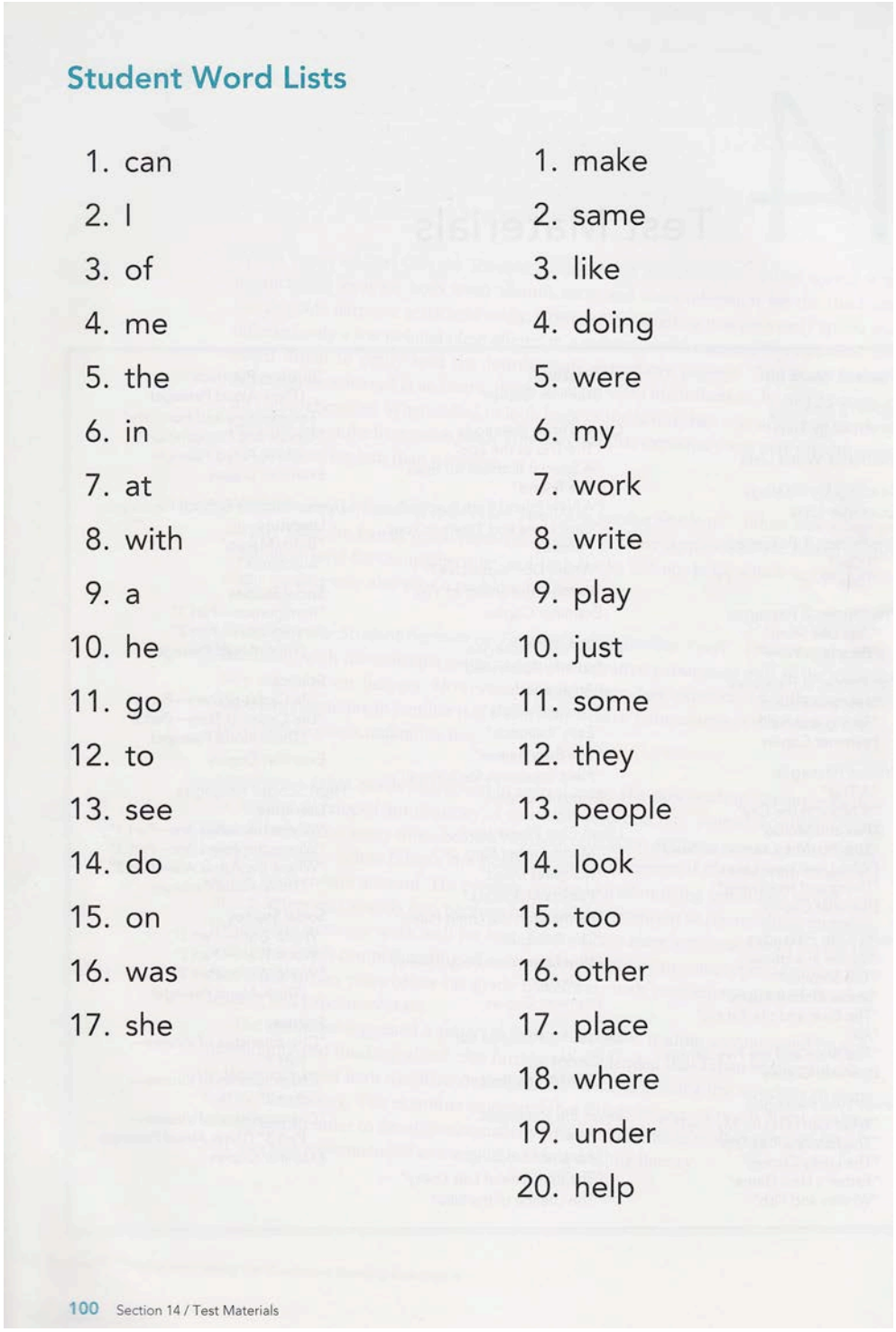
continue to adapt QRI passages so that students can be assessed using both narrative and expository passages. This would allow for a well-rounded testing of students' abilities. Furthermore, it would be useful to have the option of asking only explicit questions after reading QRI passages. The reading flexibility exercises assisted the student in better comprehending the written text, but this intervention did not teach her to make inferences. For this particular intervention, it would have been useful to have the option of asking only explicit comprehension questions to determine at what level the participant was able to recall factual information after reading a passage.

**Summary**

To conclude, utilizing reading flexibility exercises was an effective method for increasing both reading flexibility and comprehension in students with Autism Spectrum Disorder (ASD). Based upon the assessments administered, the participant in this study made gains in both her reading flexibility and reading comprehension skills. While strengths include the visuals used and the predictability of the sessions, there are several limitations that require changes to be made for future research.

**Appendix A**

**QRI Word Lists**



## Student Word Lists

| | |
|---|---|
| 1. can | 1. make |
| 2. I | 2. same |
| 3. of | 3. like |
| 4. me | 4. doing |
| 5. the | 5. were |
| 6. in | 6. my |
| 7. at | 7. work |
| 8. with | 8. write |
| 9. a | 9. play |
| 10. he | 10. just |
| 11. go | 11. some |
| 12. to | 12. they |
| 13. see | 13. people |
| 14. do | 14. look |
| 15. on | 15. too |
| 16. was | 16. other |
| 17. she | 17. place |
| | 18. where |
| | 19. under |
| | 20. help |

## Student Word Lists

| | | |
|---|---|---|
| 1. keep | 1. bear | 1. morning |
| 2. need | 2. father | 2. tired |
| 3. going | 3. find | 3. shiny |
| 4. what | 4. sound | 4. old |
| 5. children | 5. friend | 5. trade |
| 6. thing | 6. song | 6. promise |
| 7. why | 7. thought | 7. pieces |
| 8. again | 8. run | 8. suit |
| 9. want | 9. enough | 9. push |
| 10. animals | 10. brain | 10. though |
| 11. sing | 11. air | 11. begins |
| 12. went | 12. knew | 12. food |
| 13. jump | 13. put | 13. light |
| 14. read | 14. heard | 14. visit |
| 15. said | 15. afraid | 15. clue |
| 16. live | 16. wind | 16. breathe |
| 17. there | 17. choose | 17. insects |
| 18. one | 18. without | 18. weather |
| 19. great | 19. move | 19. noticed |
| 20. every | 20. then | 20. money |

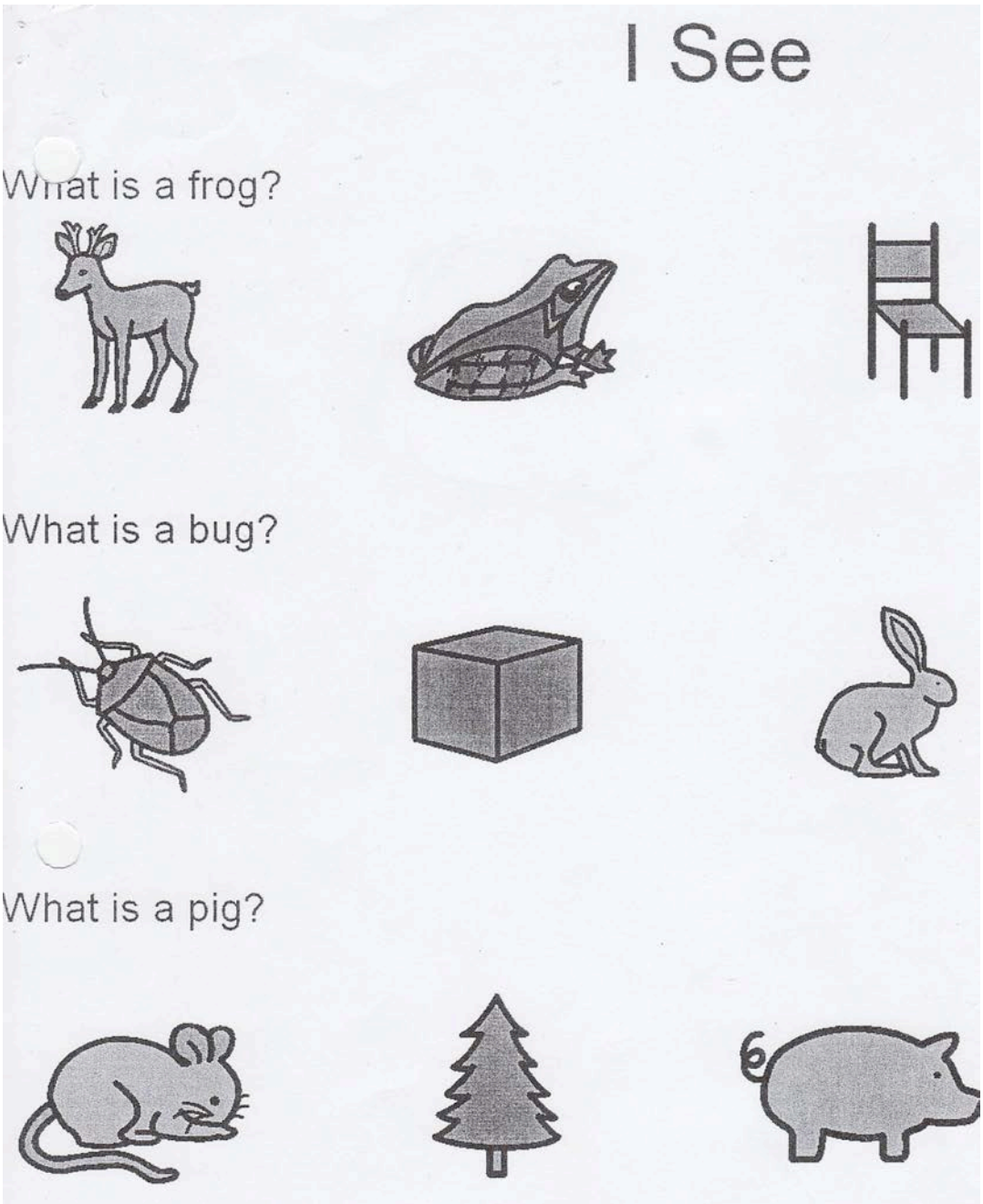
## Student Word Lists

| | | |
|---|---|---|
| 1. lunch | 1. sunlight | 1. attend |
| 2. celebrate | 2. desert | 2. protest |
| 3. believe | 3. crops | 3. movement |
| 3. confused | 4. engine | 4. biography |
| 5. motion | 5. favorite | 5. attention |
| 6. rough | 6. adaptation | 6. capture |
| 7. engines | 7. weather | 7. oxygen |
| 8. tongue | 8. pond | 8. tales |
| 9. crowded | 9. illustrated | 9. creature |
| 10. wool | 10. ocean | 10. obstacles |
| 11. removed | 11. pilot | 11. divorced |
| 12. curious | 12. fame | 12. registration |
| 13. silver | 13. precious | 13. arrested |
| 14. electric | 14. settlers | 14. poison |
| 15. worried | 15. guarded | 15. material |
| 16. enemies | 16. passenger | 16. bulletin |
| 17. glowed | 17. memorize | 17. giant |
| 18. clothing | 18. environment | 18. fluent |
| 19. interested | 19. adventurer | 19. pioneers |
| 20. entrance | 20. invented | 20. pouch |

## Appendix B

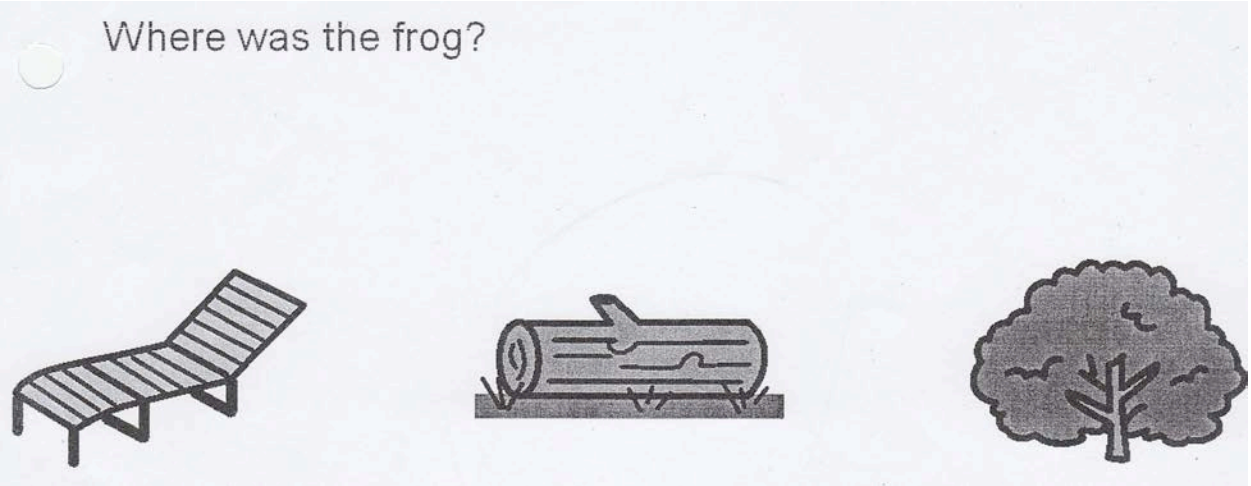
## QRI Passages

**Pre-Primer One**

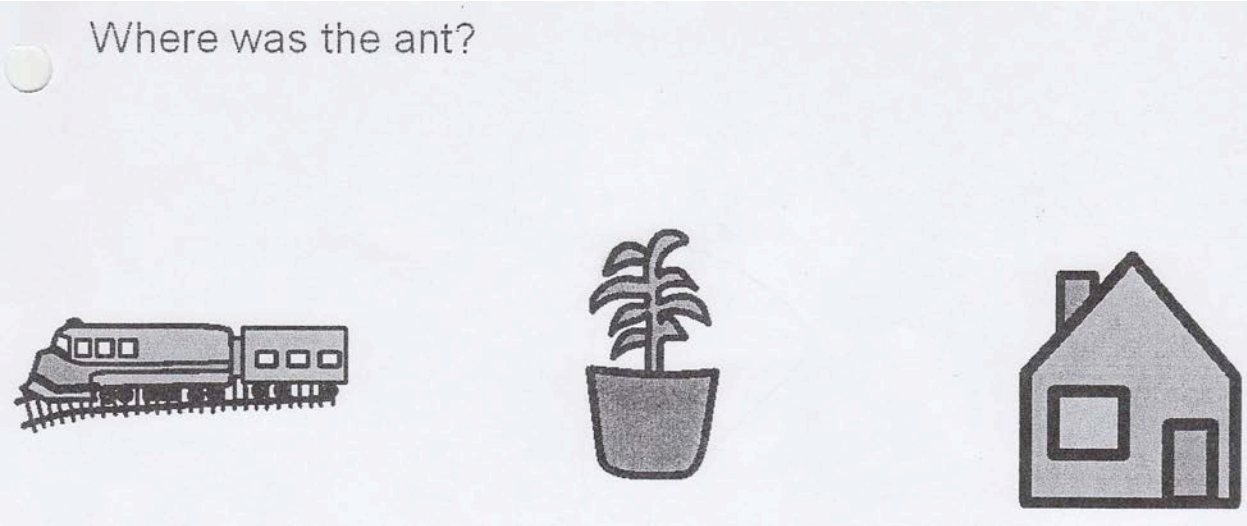


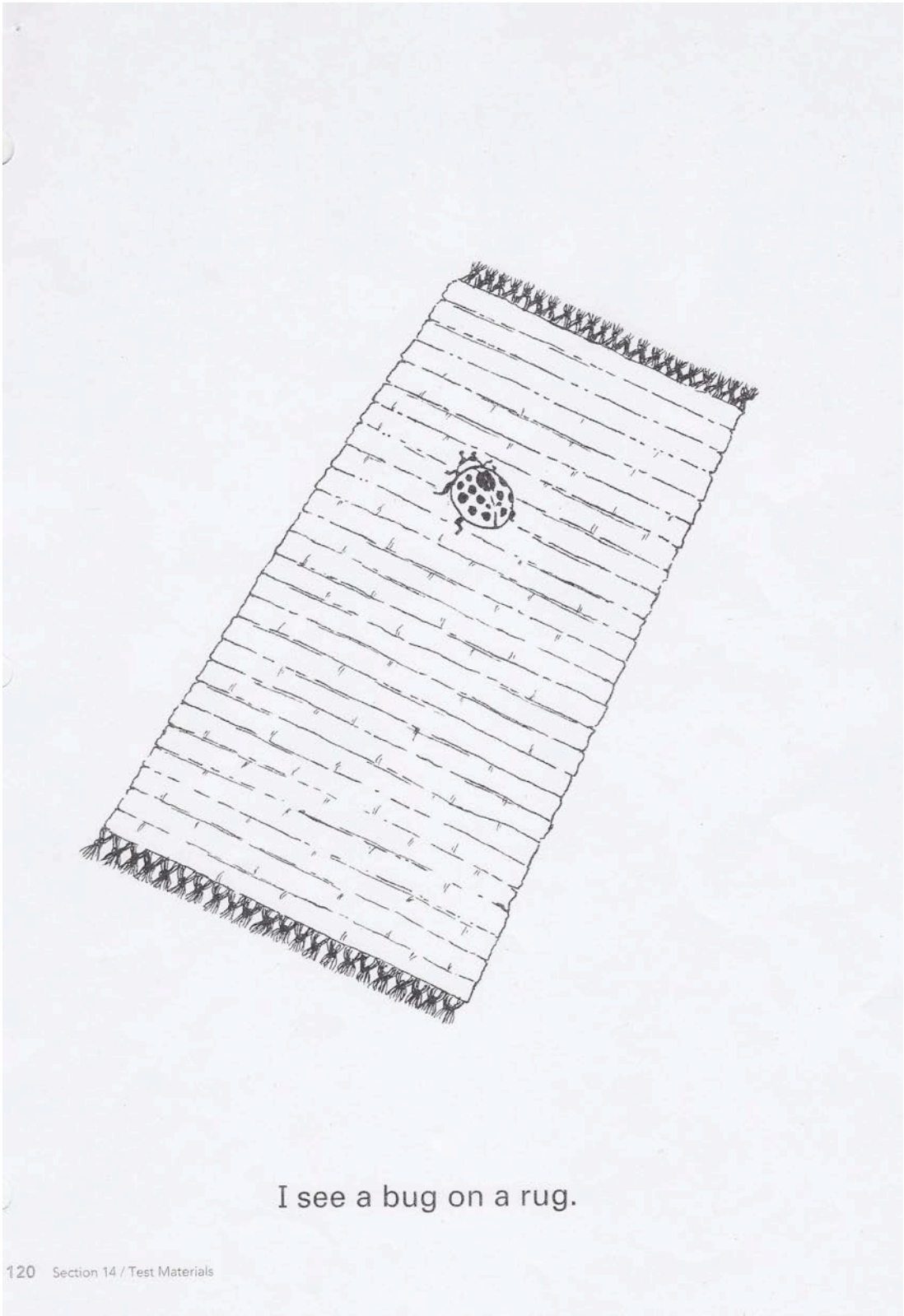
# I See

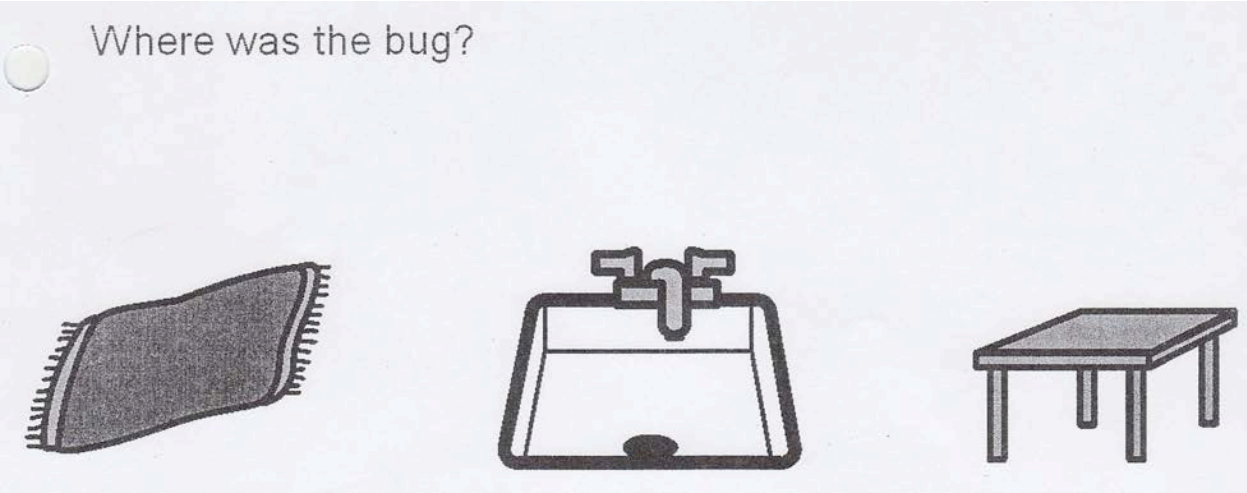
I see a frog on a log.

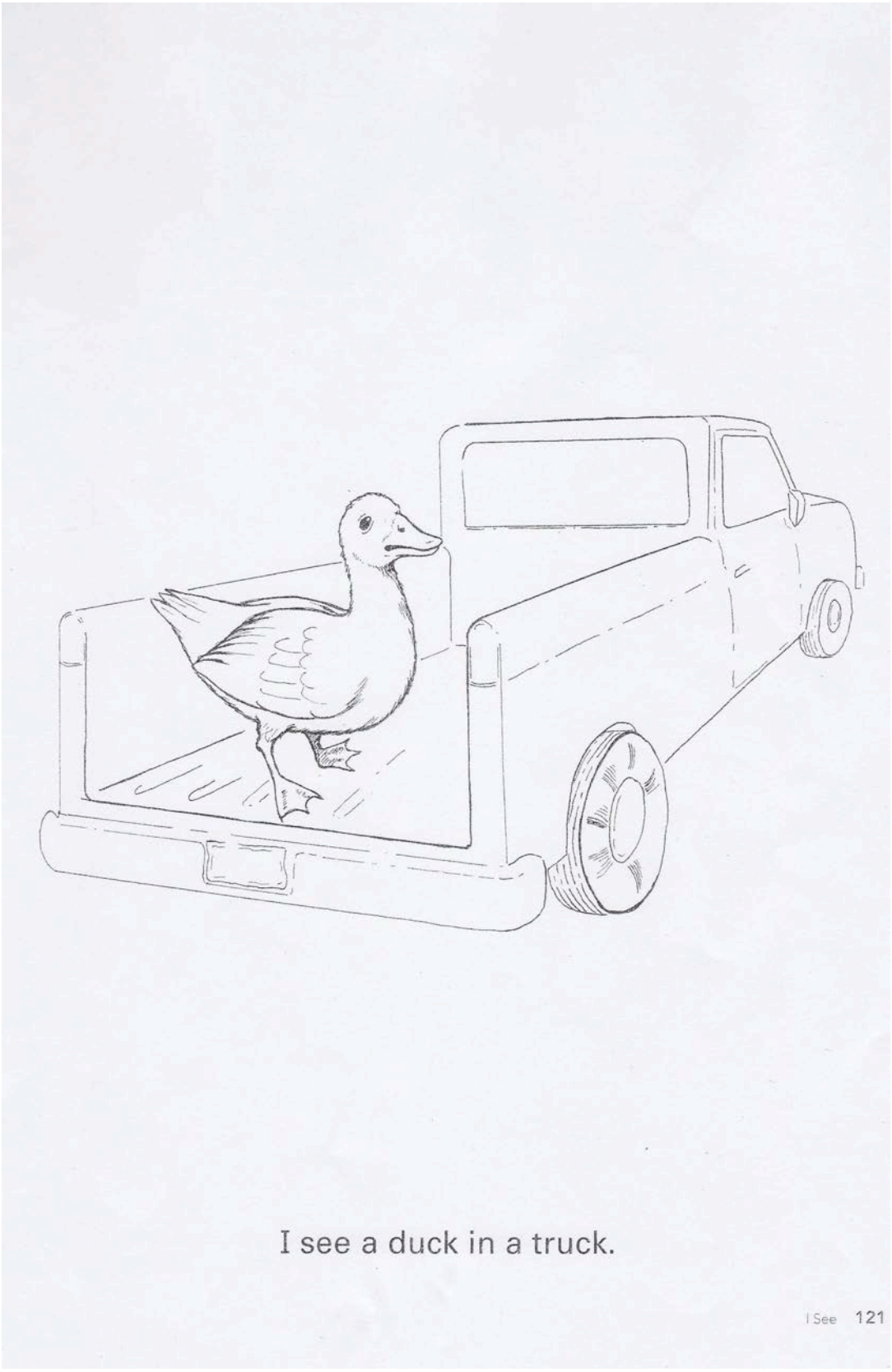

Where was the frog?


I see an ant on a plant.
I See 119

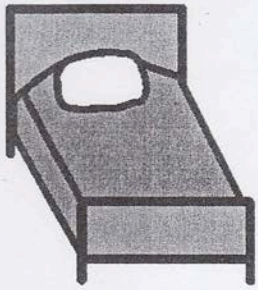

Where was the ant?

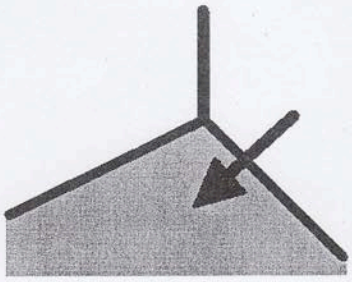

I see a bug on a rug.
120 Section 14 / Test Materials

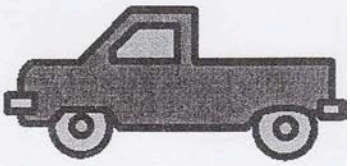

Where was the bug?


I see a duck in a truck.
I See 121

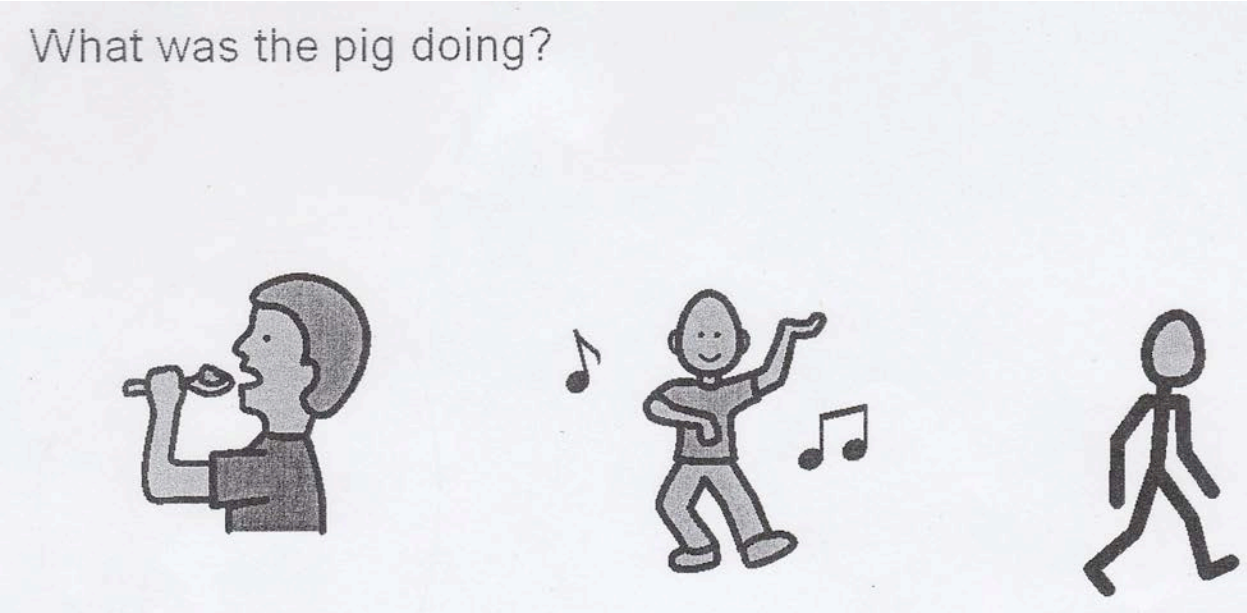
Where was the duck?







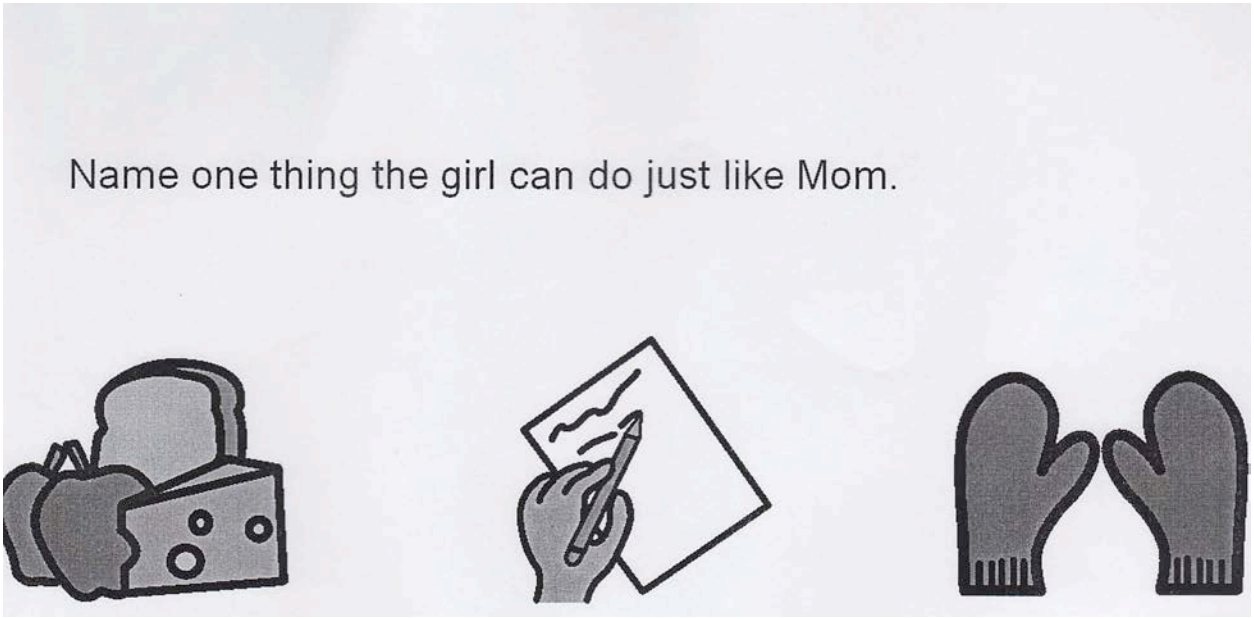
I see a pig doing a jig.

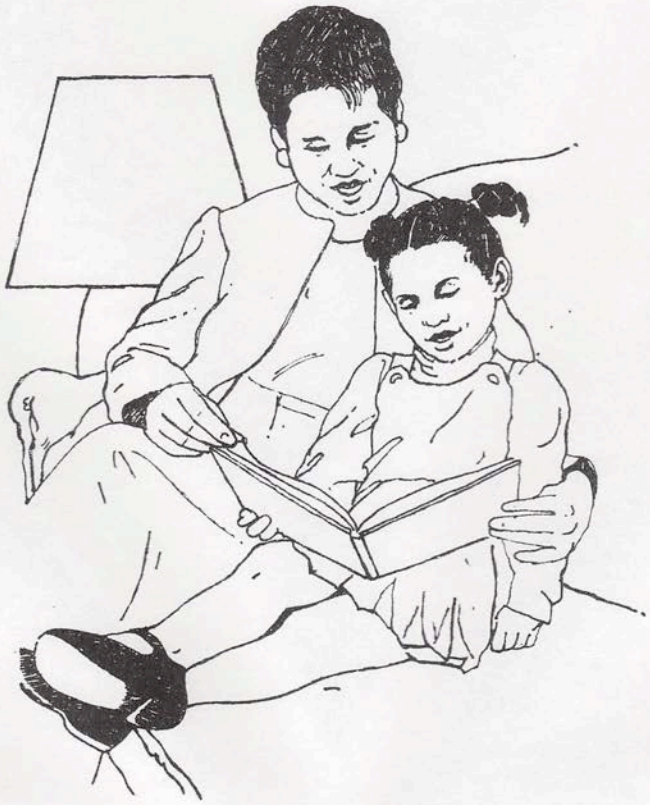

What was the pig doing?

**Pre-Primer Two**

# Just Like Mom


I can write.
Just like Mom.


Name one thing the girl can do just like Mom.



I can read.
Just like Mom.


Name another thing the girl can do just like Mom.

I can go to work.
Just like Mom.

Just Like Mom 125

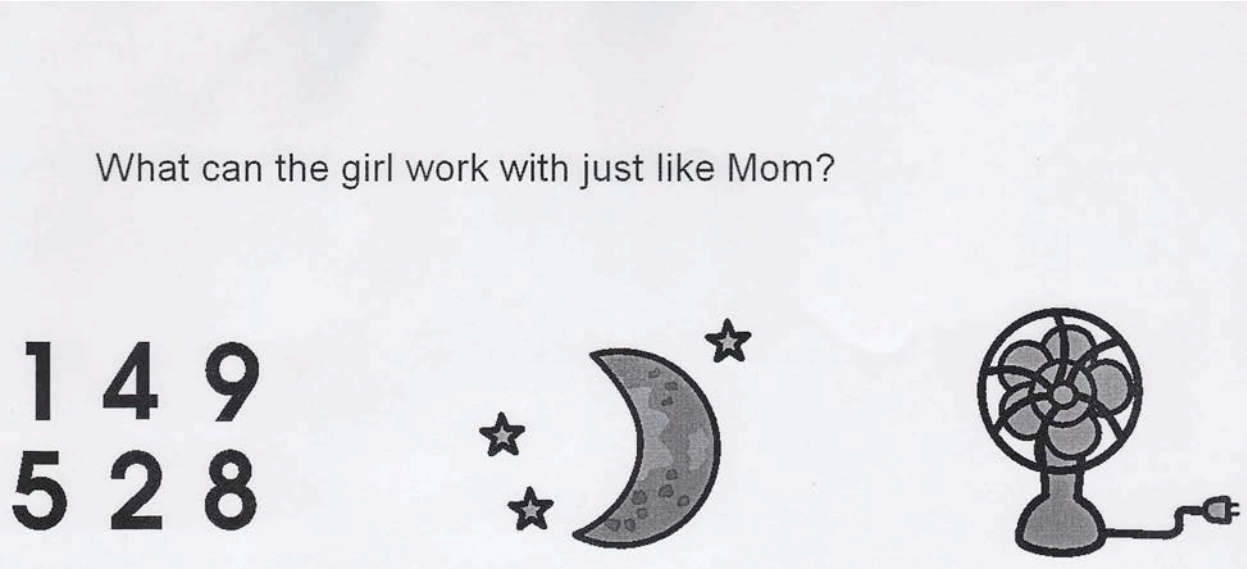

Where can the girl work just like Mom?

I can work at home.
Just like Mom.

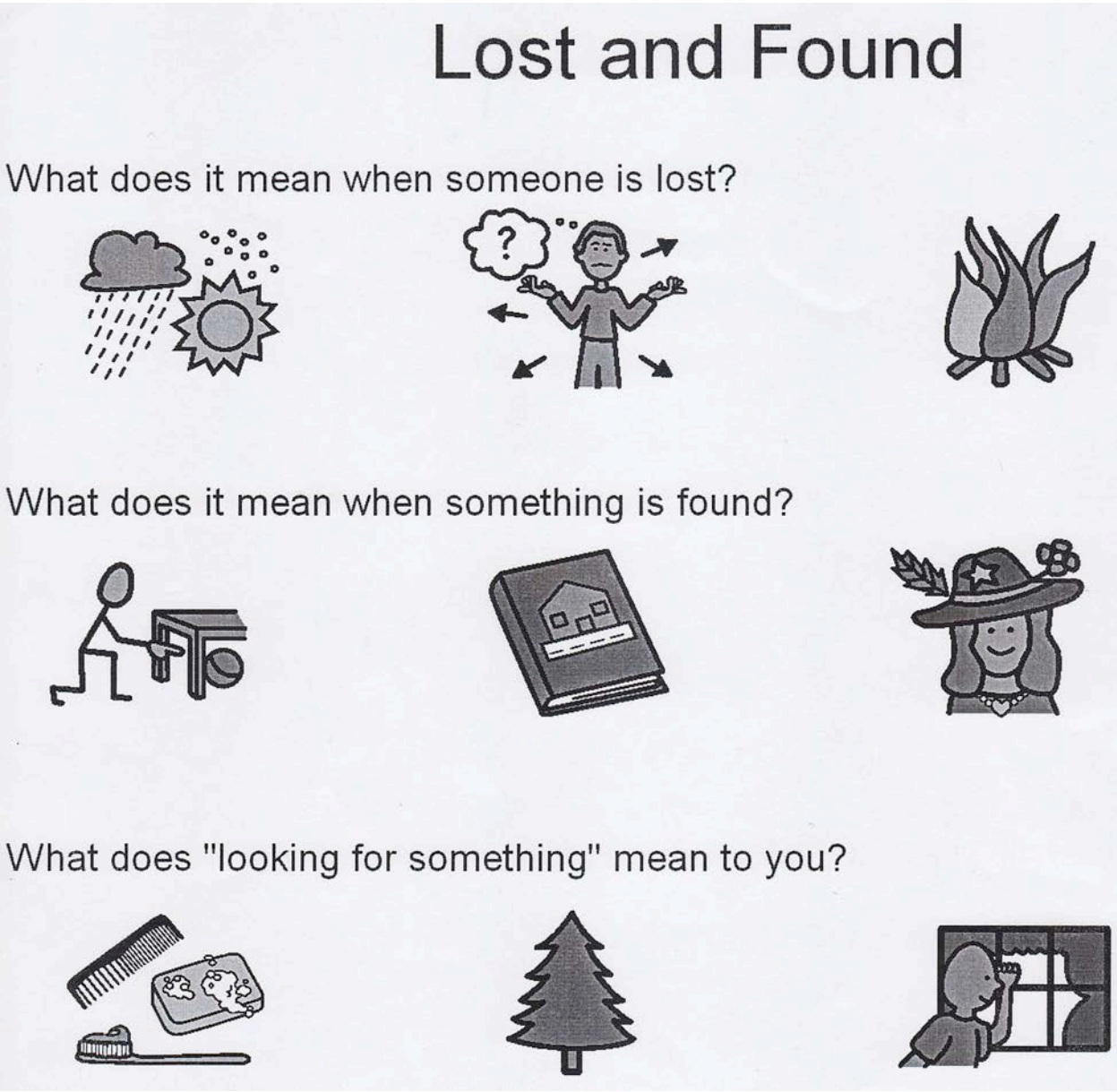
126 Section 14 / Test Materials


Where is another place the girl can work just like Mom?

I can work with numbers.
Just like Mom.
I can do lots of things.
Just like Mom.


What can the girl work with just like Mom?
1 4 9
5 2 8

**Pre-Primer Three**



# Lost and Found

I lost my cat.

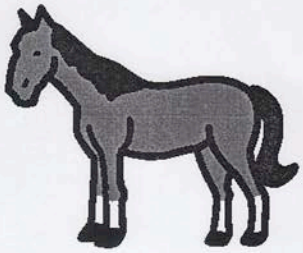
Where was she?

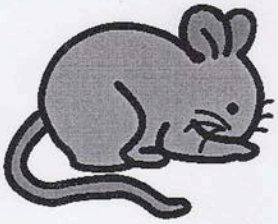
I looked inside the house.

I looked under the bed.

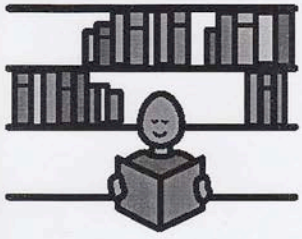
I looked outside too.

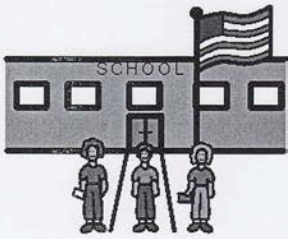
What did the person in the story lose?

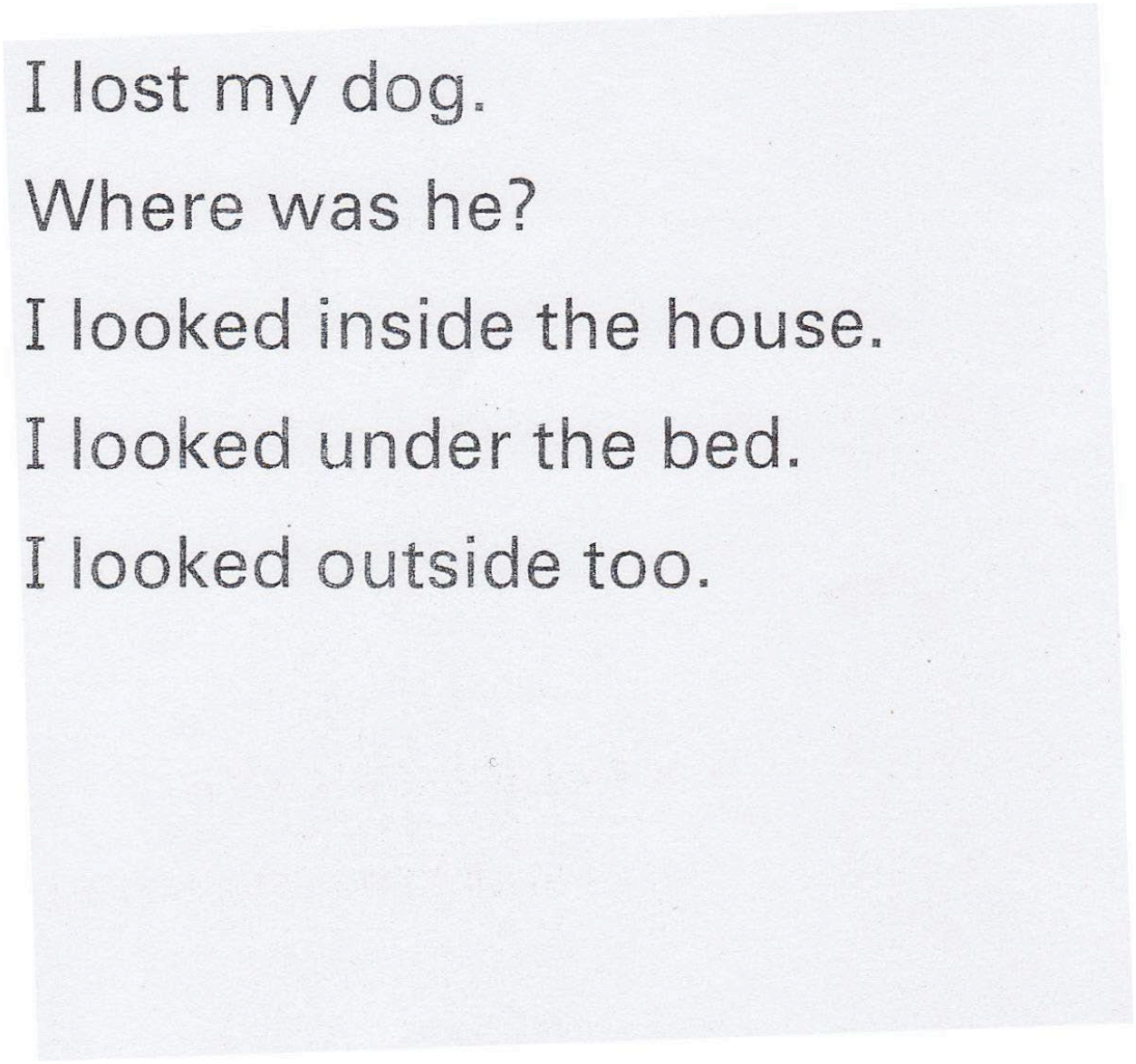




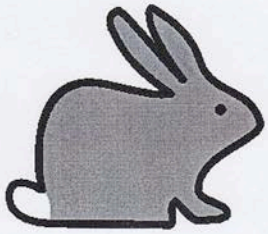
Where did the person in the story look?

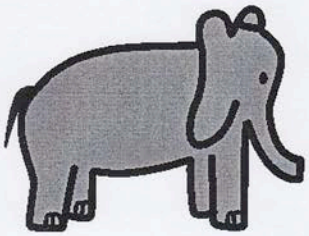




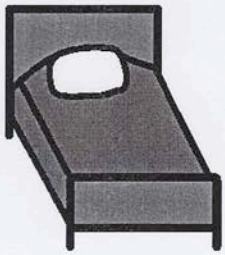

I lost my dog.
Where was he?
I looked inside the house.
I looked under the bed.
I looked outside too.

What else did the person in the story lose?





Where else did the person in the story look?



I found my cat.

I found my dog.

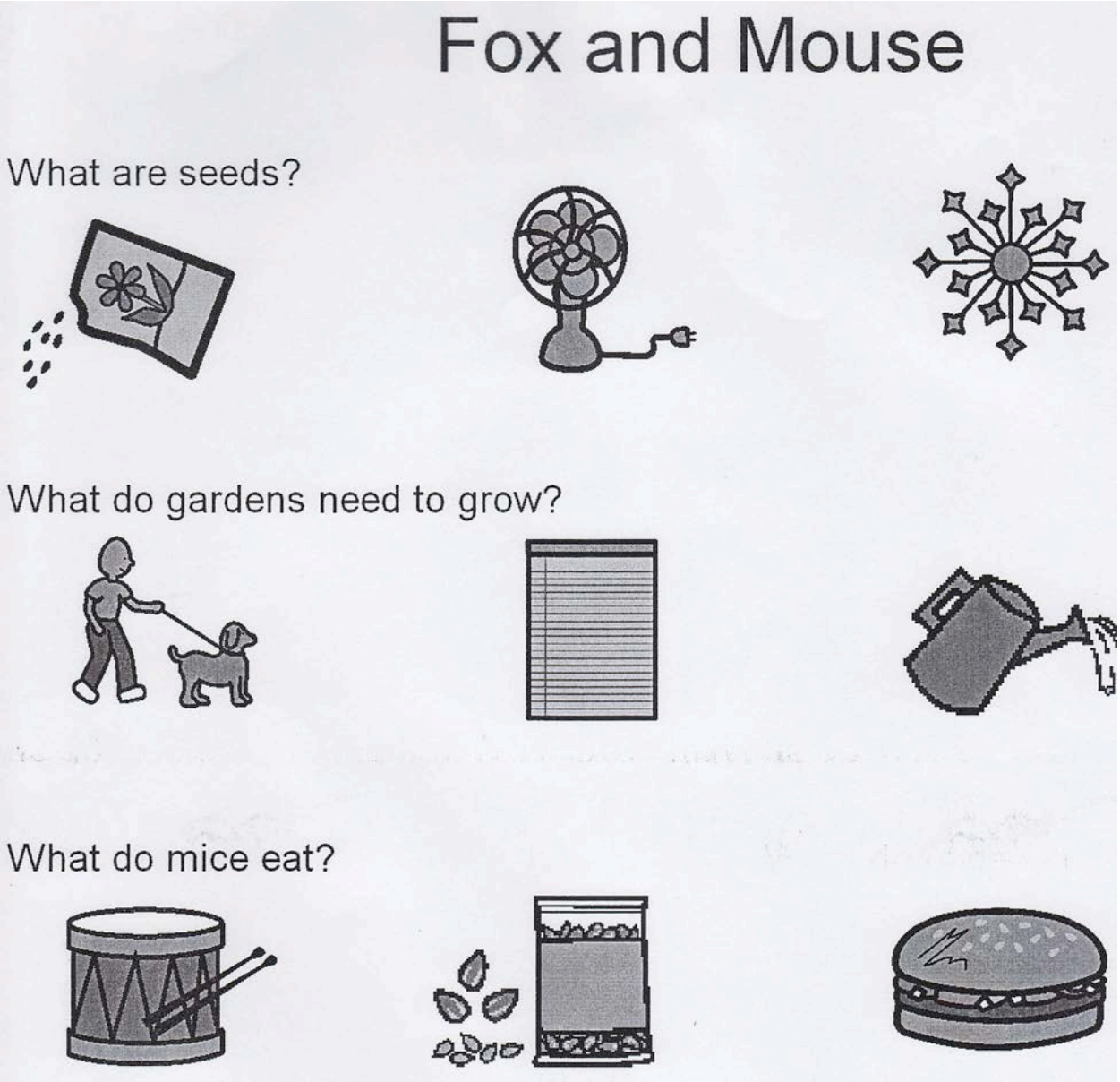
Where were they?

They were in the same place.

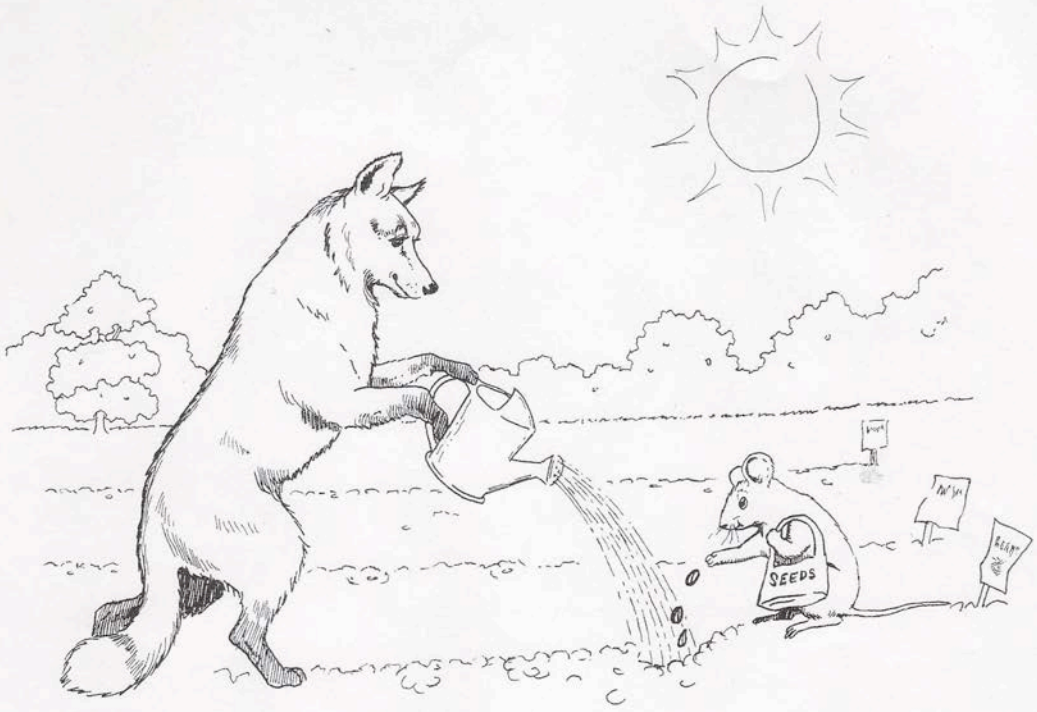
They were under the table.


Where did the person find the dog and cat?

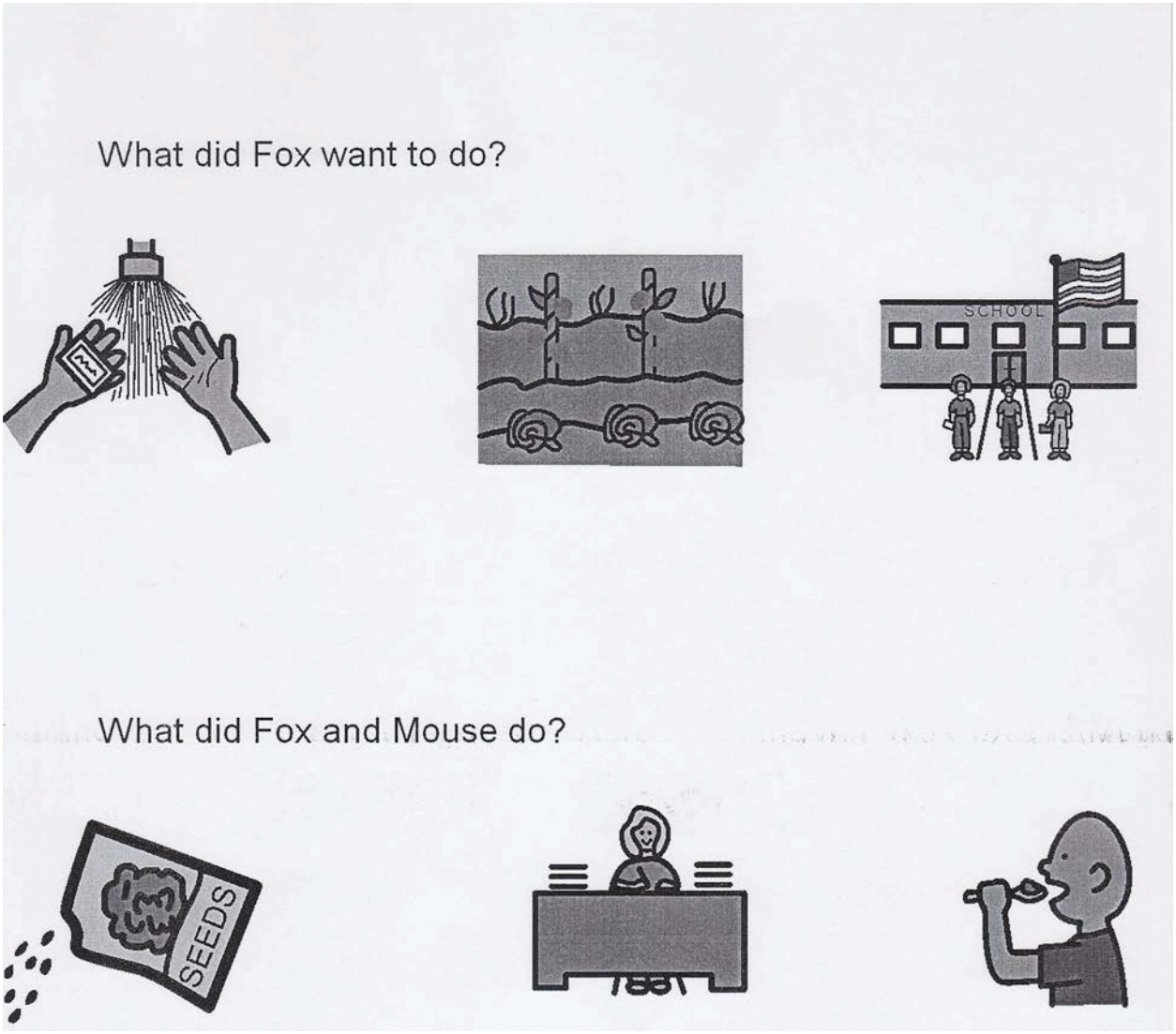
**Primer**


Fox and Mouse
What are seeds?
What do gardens need to grow?
What do mice eat?

# Fox and Mouse

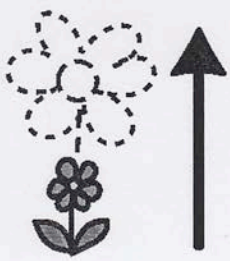


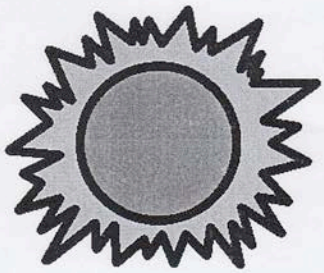

Fox wanted to plant a garden.
Mouse helped him.
They put the seeds in the ground.
They watered the seeds.
Then they waited.

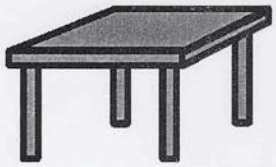

What did Fox want to do?
SCHOOL
What did Fox and Mouse do?
SEEDS

One night Mouse went to the garden.
He dug up one of the seeds.
He wanted to see if it was growing.
The seed looked good to eat.
"It is only one seed," thought Mouse.
"Fox will not know who ate the seed."

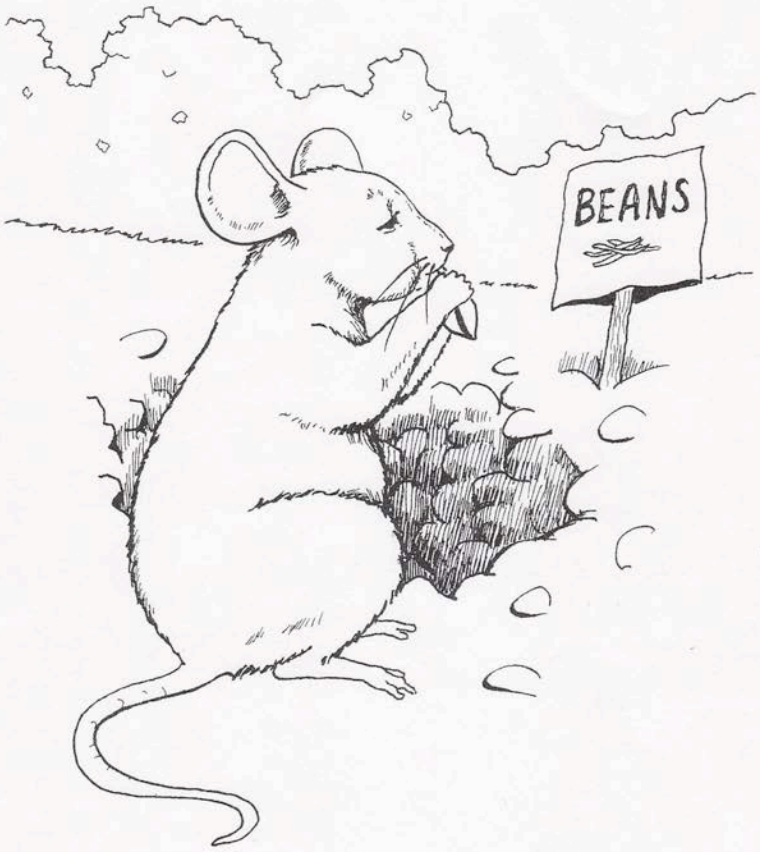
Why did Mouse dig up the first seed?





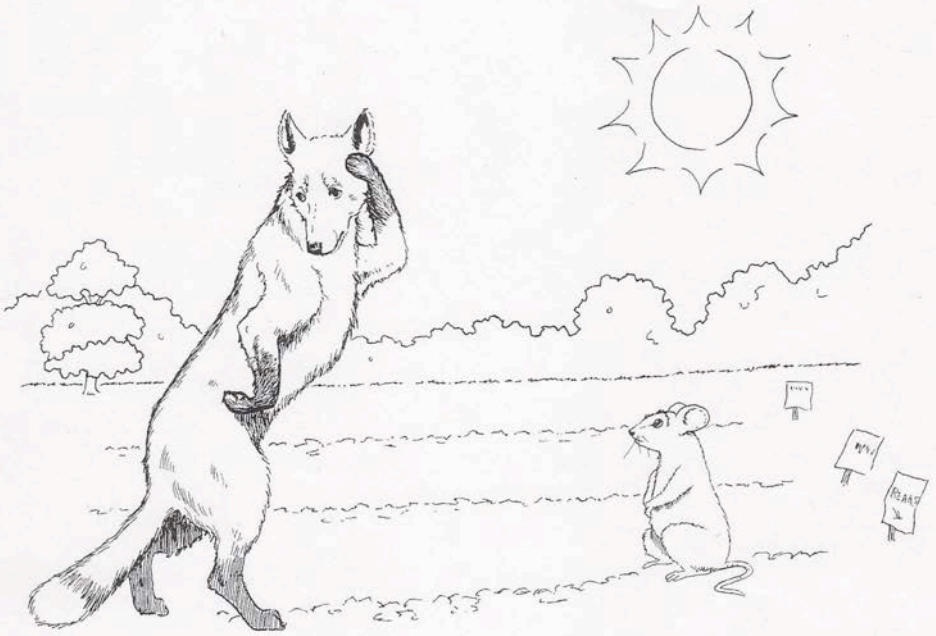


What did Mouse do with the first seed that he dug up?




The next night Mouse went to the garden again.
He dug up one seed and ate it.
He did this every night.
After a few weeks, all the seeds were gone.

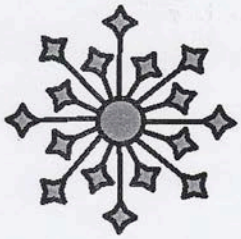

What did Mouse do with the next seed that he dug up?



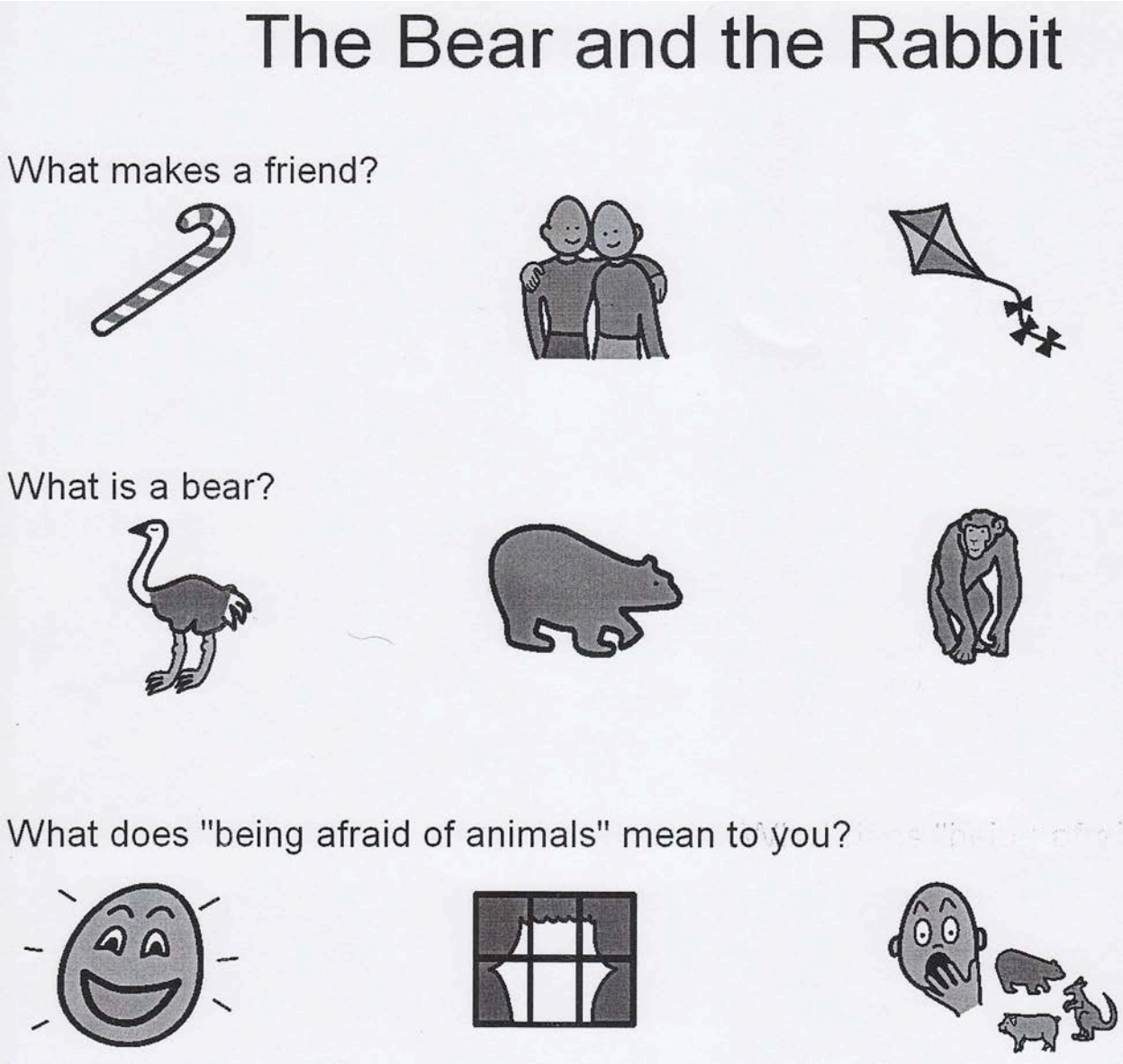
"I wonder why the seeds didn't grow," said Fox.
Mouse didn't say a word.
So Fox planted more seeds.
And Mouse helped him.

Why didn't the garden grow?

Why did Mouse help Fox plant the garden again?



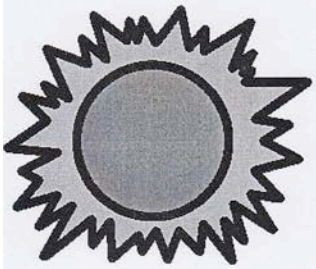
**Grade One**

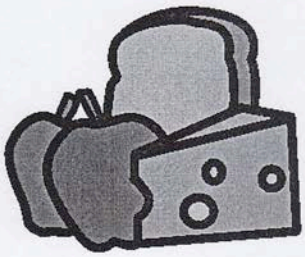

The Bear and the Rabbit
What makes a friend?
What is a bear?
What does "being afraid of animals" mean to you?

# The Bear and the Rabbit

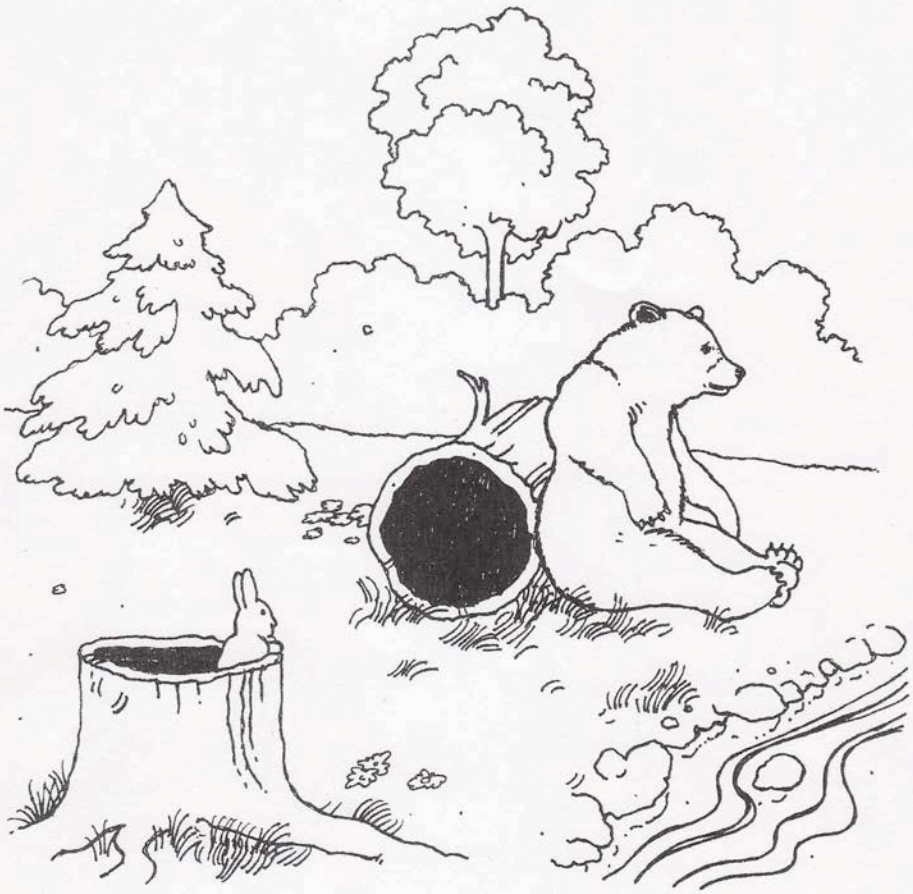
Once there was a very big bear.
He lived in the woods.
He was sad because he didn't have anyone to play with.
He said to his father, "How can I find a friend?"
His father said, "By being you."
"But all the animals are afraid of me," said the bear.
"I can't even get near them."

Why was the bear sad at the beginning of the story?





Why did the father think that the bear could find a friend just by being himself?



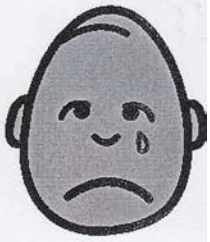
But one day the bear was sitting by a river.
He was singing softly to himself.
A rabbit lived near the river.
He looked out of his hole when he heard the bear's song.
He thought, "Anyone who sings like that must be nice.
Maybe I don't need to be afraid of him.
It would be nice to have a friend."

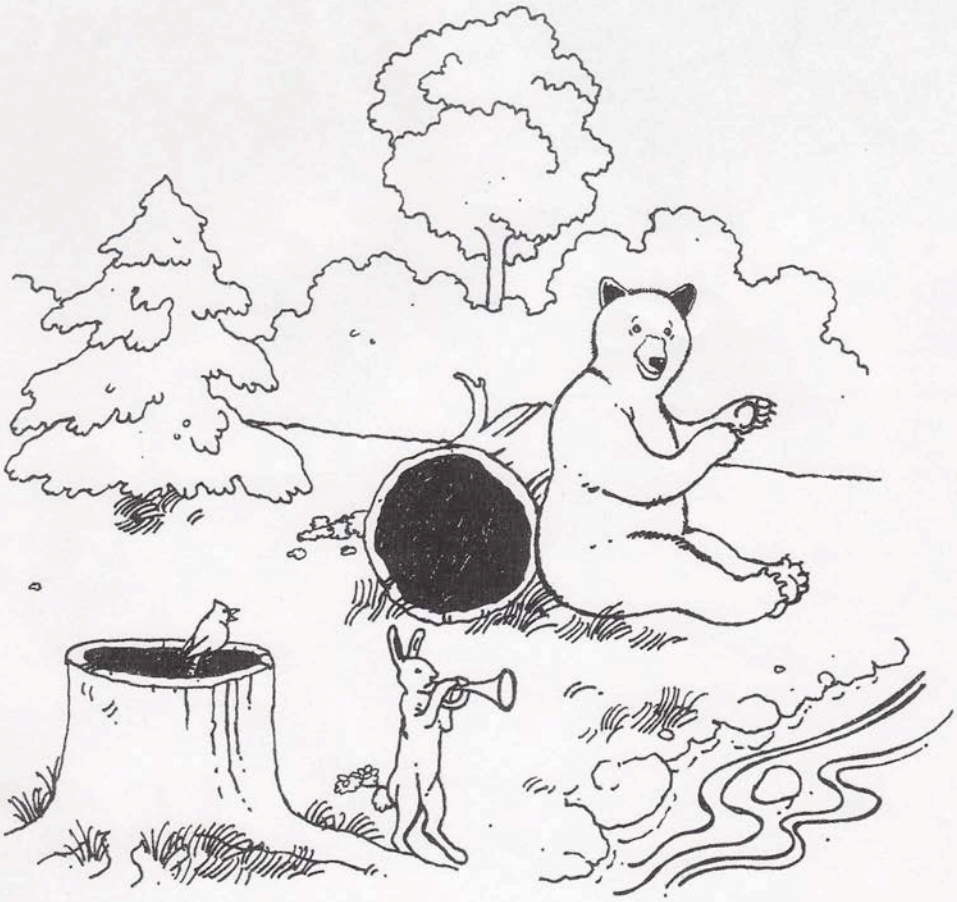
What was the bear doing as he sat by the river?



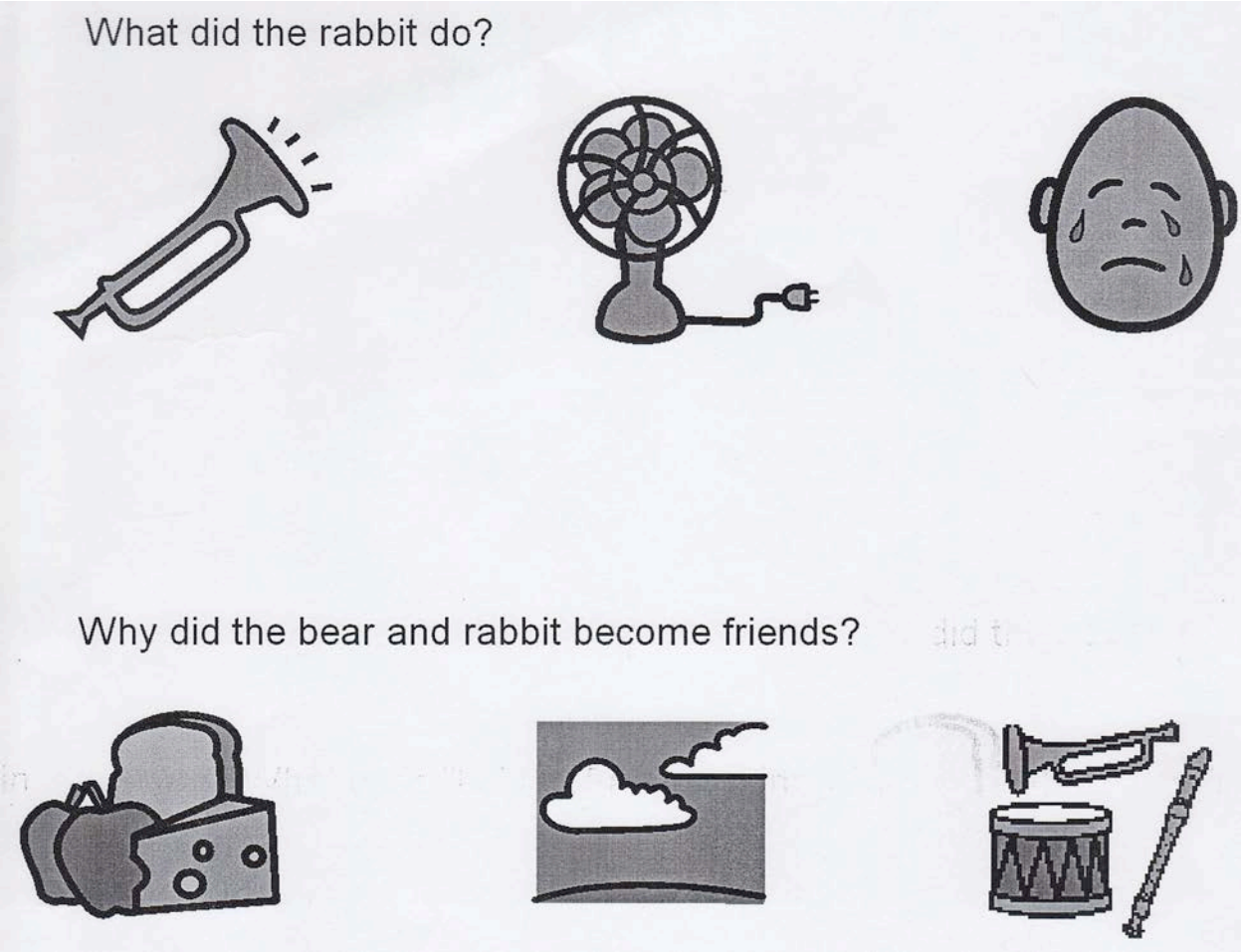
What did the rabbit think when he hear the bear singing?







The rabbit went and got his horn.
Very softly he began to play.
His music went well with the bear's song.
The bear looked around.
He couldn't see the rabbit.
Slowly, the rabbit walked up to the bear.
He kept playing and the bear kept singing.
They were both happy that they had found a friend.
And a bird joined in the song.


What did the rabbit do?
Why did the bear and rabbit become friends?

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