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Developing the Rapid Assessment of Problem Solving for Kids (RAPS-K)

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DEVELOPING THE RAPID ASSESSMENT OF PROBLEM SOLVING FOR KIDS (RAPS-K)

A Capstone Project Presented in Partial Fulfillment

of the Requirements for the Degree Bachelor of Science

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at Western Kentucky University

By

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ABSTRACT

The Rapid Assessment of Problem Solving (RAPS) was created by Dr. Robert Marshall in order to assess an individuals' problem solving abilities. This assessment is set up like the popular twenty-questions game and is used to assess adults with cognitive impairments. An administrator chooses a picture from a board of thirty-two pictures and the subject must ask yes or no questions in order to guess the target picture in as few questions as possible. Analysis assesses integration planning scores, question asking efficiency scores, and question types to determine a level of problem solving abilities.

Smith and Jones (2018) used the original RAPS to assess problem solving skills in neurotypical children and discovered many limitations such as the inability of children to recognize the pictures used and the number of pictures they were able to integrate. Perdew (2019) created a modified version of the RAPS called the Rapid Assessment of Problem Solving for Kids (RAPS-K) that addressed these limitations, in hopes it would be more valid and reliable when used with the child population. The RAPS-K consists of twelve total boards of varying sizes that fit into three levels of difficulty.

This capstone project aims to analyze data gathered through the piloting of the RAPS-K on neurotypical kids. From this research, any limitations of the new boards or of the original scoring system when used in conjunction with the new boards will be identified and modified for future use. Additionally, a protocol and administration manual will be created in order to make administration more uniform and valid.

Keywords: problem solving, children, neurotypical, assessment, RAPS

I dedicate this thesis to all of my loving friends and family who encouraged and believed in me even during the crazy times. Your endless support means the world and continues to carry me to new heights.

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VITA

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CHAPTER I: INTRODUCTION

Problems in daily life are inevitable. Therefore, the ability to problem solve is an essential tool in overcoming obstacles and maneuvering problems in order to better navigate life. In most situations, neurotypical individuals are able to problem solve with very little effort, oftentimes not even realizing they are using those skills. These are ingrained abilities many take for granted. On the other hand, for adults and children who have acquired or developmental cognitive disabilities, problem solving abilities are impaired and require much more effort. These impairments cause various implications in daily life.

Due to the importance of problem solving in everyday life, it is essential that professionals have a valid and reliable way to assess the problem solving skills of an individual. The Rapid Assessment of Problem Solving (RAPS) (Marshall, Karow, Morelli, Iden, & Dixon, 2003; Marshall & Karow, 2008) was created in order to assess problem solving abilities, specifically in adults who had acquired a traumatic brain injury (TBI) or other cognitive disabilities. This assessment, based on the popular twenty-question task, was set up in a game-like format that presented the patient with picture boards and prompted him/her to ask yes and no questions in order to determine the selected picture. Because of the nontraditional structure and very few alternative methods to test similar executive functioning abilities in children, researchers believed the RAPS could be used to assess problem solving skills in children. When considering other assessments that tested similar skills, limitations included complex instructions, lack of engaging materials, and excessive motor and expressive language demands (Smith,

2015). Jones (2018) used both the RAPS and another notable cognitive ability test, the Raven's Progressive Matrices (RPM) (Raven, Raven, & Court, 1983), to compare administration and effectiveness with children. The RPM was found to be unsuitable for the younger population due to a longer administration time and abstract concepts. While the RAPS was more engaging and had a shorter administration time, it was also found to have limitations such as limited recognition of pictures.

To account for the limitations, the RAPS was modified and new boards were created to address the needs specific to the child population (Perdew, 2019). This modified RAPS, termed the Rapid Assessment of Problem Solving for Kids (RAPS-K), contained age-appropriate pictures that were verified through picture recognition testing. A total of twelve boards were created and categorized into three different levels of difficulty based on the number of pictures presented on the board.

This capstone project aims to pilot the RAPS-K boards and determine whether or not the modified version was more appealing and able to better hold a child's attention. Data will be analyzed from administration of the RAPS-K on a total of fifty-three neurotypical children between the ages of 4:7 and 11:0. Each child was administered three boards, one from each difficulty level. The goal of the project is to identify any weaknesses in the new boards and create a modified administration manual and protocol in order to provide a uniform way of presenting instructions and gathering and recording data. Additionally, any notable trends in the data regarding problem solving ability among children will be identified and explored.

CHAPTER II: LITERATURE REVIEW

Problem solving is a higher-order level of cognition referred to as executive functioning. This type of skill is necessary to maneuver daily life and overcome a range of obstacles that interfere with typical routines. It is known that injury to the frontal lobe of the brain, particularly through traumatic brain injury, has the potential to cause deficits in problem solving ability. Marshall and Karow (2003) found that commonly used problem solving assessments were too taxing on individuals with brain injuries. Their cognitive impairments made it difficult for them to understand the complex set of instructions, as well as stay engaged throughout the entirety of the test. They concluded that a new type of assessment that had a shorter administration time and easy-to-understand instructions was needed to better suit this population.

To accommodate the brain-injured population, Marshall and Karow (2003) created a problem solving assessment based of the popular twenty-question game. The game, derived from a test called the Twenty Questions Test (20Q), was created by Mosher and Hornsby (1966). The test centered on a test administrator selecting one picture from a group of pictures and challenging the subject to guess the selected picture by only asking questions that could be answered by a yes or no response. The goal was to guess the picture with as few questions as possible. This is a task that requires higher-level cognitive thinking and the ability to problem solve. An individual must understand the goal, integrate the pictures shown, and group them in ways that eliminate as many as possible.

The Rapid Assessment of Problem Solving (RAPS) was created to mimic the 20Q in hopes that the game-like structure and short administration time would be more appealing and more practical to test verbal problem solving skills of individuals with a brain injury or cognitive disorder. It was hypothesized that this test would provide more accurate results for children because it was presented as a familiar game and "…tests that have some relationship to one's past experiences enhance motivation by creating a desire to succeed or 'win' versus fear of being identified as impaired" (Marshall & Karow, 2003, p. 385). Modifications were made to the materials and the administration to better accommodate to the neurologically compromised population. Modifications included boards with fewer pictures, pictures in both color and black and white, clearer instructions, covering the pictures that were eliminated, and terminating the test after ten questions in order to avoid frustration (Marshall et al., 2003).

Nine boards were created, each with a total of 32 pictures. Of the 32 pictures, half were in color and half were black and white; furthermore, they were grouped into one category of eight, two categories of six, and three categories of four. Each board had a strategic structure that consisted of alternating between colored and black and white pictures, as well as no two pictures from the same category touching (above, below, or adjacently). Similar to the 20Q, the clinician chooses a picture and the participant asks yes or no questions in order to determine the selected picture. The test concludes when the participant narrows the field to two or three questions or if he/she explicitly guesses the target picture. Participants are told that the goal is to ask as few questions as possible.

Scoring is based on the types of questions the participant asked and how effective the questions were in narrowing the field. This is done by recording each question asked,

the yes or no response, the total number of pictures considered before the question was asked, the number of pictures targeted by the question, and the number of pictures eliminated. Each question is then given a question efficiency by dividing either the number of pictures targeted or number of pictures eliminated (whichever is smaller) by the total number of pictures considered. This quotient is then multiplied by two to determine the efficiency of the question asked. The first four question efficiency scores are averaged to generate a Question Asking Efficiency (QAE) score. In addition to the QAE score, each question is categorized into one of three question types: Constraint-Seeking (CS), Hypothesis-Scanning (HS), and Pseudo-Constraint (PS). CS questions are those that narrow the field by eliminating more than one picture, regardless of a yes or no response. HS and PS questions are both a type of guess that only eliminate one picture if answered with a 'No' and solve the problem if answered with a 'Yes.' These questions are high-risk and high-reward, but not necessarily effective. HS questions explicitly ask if it is a certain picture, whereas PS questions are formulated to sound like a constraint, but only target a single picture. CS questions reflect an individual's ability to integrate pictures and categorize them in order to ask more effective questions, indicating a higher level of thinking and more advanced level of problem solving (Marshall & Karow, 2003).

After the RAPS was released to the public as a clinical measure of problem solving, Smith (2015) determined the need for a problem solving assessment that could be used with the child population. While the RAPS was intended for use with adults with brain injury, Smith led a project that studied the effectiveness of the RAPS when used to assess children. This study used three different age groups of children in order to yield comprehensive results. Seventy-three typically developing young children between the

ages of seven and nine, 79 typically developing early adolescents between the ages of ten and 13, and 77 adolescents between the ages of 14 and 17 were given the RAPS. Results indicated that, while the two older groups asked more CS questions and were able to determine the target picture more efficiently, all the groups had a difficult time integrating all of the pictures. The RAPS proved to be effective at assessing problem solving abilities, but it was at too high of a level and therefore, not fully effective for this specific population.

Smith (2015) also created a screening to be administered to the participant before the RAPS. The screening was created to ensure the participant had the necessary skills to successfully participate in the RAPS. Two components made up the screening: a picture recognition and oral naming section and a yes/no question formulation section. The picture recognition and oral naming section is used to ensure that the participant will be able to recognize and name pictures shown on the boards. An individual with severe or profound cognitive impairments may not be able to name pictures, indicating that this assessment would not be suitable for him/her. Thirty pictures, half in black and white and half in color, were randomly chosen from the pool of 126 images used in the RAPS and when shown to the participant, he/she was required to correctly name 80% of them in order to pass. The yes/no formulation section was included to ensure that the participant was able to ask yes/no questions. He/she was shown one of two boards with twelve pictures each and based on those boards, was prompted to guess which picture was targeted by using only yes/no questions. Only two appropriate yes/no questions needed to be asked for the participant to pass. After the screening was completed and the

administrator confirmed that the participant had the necessary cognitive skills required, he/she could continue on with the assessment.

The primary reason for creating the RAPS was to accommodate those with brain injuries or other cognitive disabilities that resulted in executive functioning deficits. Another clinical group with known executive functioning deficits is the autism population. In 2018, Jones hypothesized that the RAPS could be utilized for those diagnosed with autism spectrum disorder (ASD) due to similar cognitive impairments. In order to test this hypothesis, Jones (2018) created a baseline and used the RAPS to assess both neurotypical children and children with an ASD diagnosis. Subjects included 27 children, 15 neutrotypical and twelve who had confirmed ASD diagnoses.

Results exposed variances in scores between the two populations, which could be attributed to differences in the way either group solved problems. Data did not prove one way was more effective than the other, but trends depicted a discernable difference in the way either group determined the target picture. Furthermore, data reinforced the need for a child-centered modification of the RAPS. Jones (2018) reported the boards were too large and neither the language nor pictures used were tailored to children, creating unintentional barriers that made it more difficult to complete the task. Suggestions for the modified RAPS included future boards to be made smaller and include vocabulary and images more familiar to children.

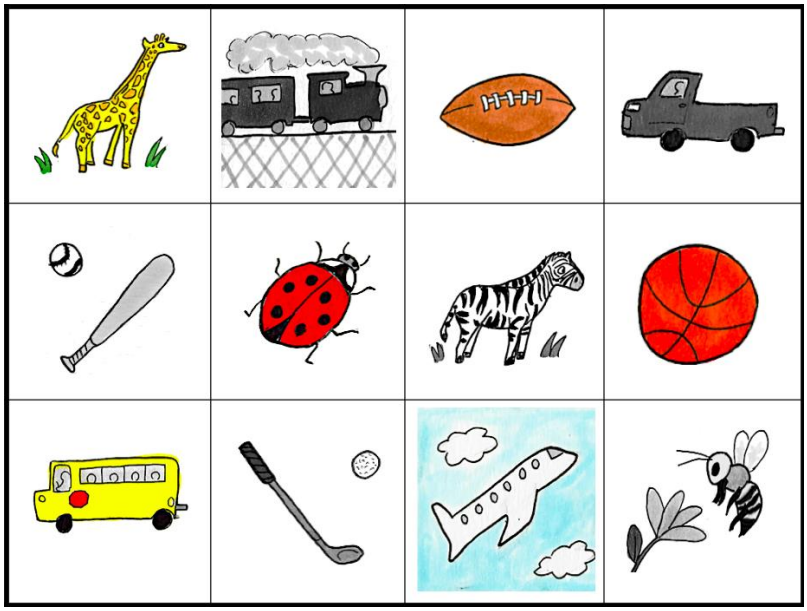
In addition to observable findings and suggestions, Jones (2018) created a database for the results of the assessments administered. She concluded that, because the original RAPS was created for a specific population of brain-injured and cognitively compromised adults, the results would be skewed when given to children. Children's

scores on the RAPS, whether neurotypical or diagnosed, would not be an accurate reflection of their true executive functioning skills because they were not the intended audience of the assessment. A child's ability to integrate pictures should be reasonably lower than an adult's due to typical brain development. Similarly, a child's lack of picture recognition due to generational differences does not prove diminished executive functioning, it only proves that he/she is not familiar with the pictures and therefore has a more difficult time integrating them. For these reasons, a child's score could be low due to the unintentional barriers as opposed to a low problem solving ability and should not be considered accurate.

In 2019, Perdew modified the RAPS boards and renamed the new collection the Rapid Assessement of Problem Solving for Kids (RAPS-K) using Marshall and Karow's (2003) original RAPS boards and suggestions from Smith (2015) and Jones (2018). Previously stated limitations were taken into consideration in order to make proper adjustments that made the boards more suitable for children. Using new pictures, Perdew (2019) created a total of twelve boards classified in groups of four into three varying levels of difficulty, each level being a different sized board. The varying levels account for the developmental differences in picture integration and problem solving abilities among children of different ages. The difficulty of the boards was also determined based on the categories included in each one. Four twelve-item 'easy' boards were created with a total of twelve pictures divided into two categories of four and two categories of two. Four 24-item 'medium' boards were created with a total of 24 pictures divided into one category of eight, two categories of six, and one category of four. Finally, four 32-item

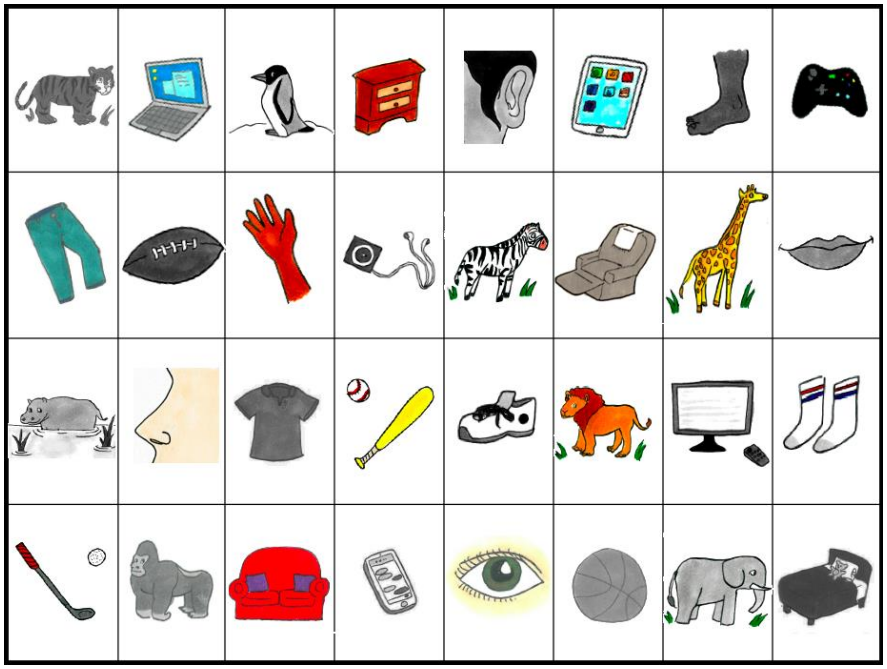
'hard' boards were created with a total of 32 pictures divided into one category of eight, two categories of six, and three categories of four.

Figure 1.1: RAPS-K board 12.1 (See Appendix A)



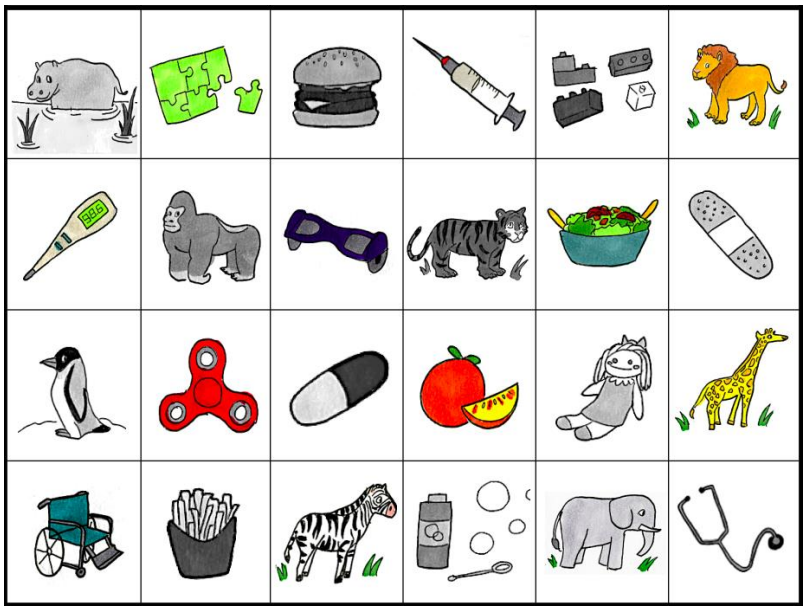
Note. Artwork by Rachel Peavler.

Figure 1.2: RAPS-K board 24.1 (See Appendix A)



Note. Artwork by Rachel Peavler.

Figure 1.3: RAPS-K board 32.1 (See Appendix A)



Note. Artwork by Rachel Peavler.

All 128 of the pictures used for the RAPS-K were originals that underwent picture recognition testing with 47 children ages 5:0 to 9:11 to validate that children could correctly identify them. The pictures used were also all intentionally chosen to reflect STEAM (science, technology, engineering, art, mathematics) vocabulary with which children would be familiar. The RAPS-K boards followed the same rules as the original RAPS boards. On all twelve boards, half of the pictures were in black and white and half were in color. Black and white pictures could not touch each other adjacently; the same parameter applied for the colored pictures. Additionally, no two pictures in the same category could touch each other adjacently. Largely, the instructions given to the participant were the same as those used in the RAPS because they were already created to be less complex to tailor to a population with lower cognitive functioning. The only difference is that the child does not have to specifically ask for the directions to be repeated. Instead, confusion or misunderstanding could be noted through behaviors,

facial expressions, or other nonverbal cues and the administrator would be able to restate instructions for more clear understanding. Additionally, Perdew (2019) modified the screening, specifically the picture recognition and oral naming section, to accurately reflect the new pictures used. Thirty pictures, half black and white and half in color, were still removed from the possible 128, and 80% (correctly naming 24 pictures) was still required to pass. These modifications were comprised to make the adapted RAPS-K boards.

This project aims to analyze data that was collected through trialing the RAPS-K boards on neurotypical children in order to create a normative baseline. Data analysis entails reviewing the results of 53 neurotypical children between the ages of 4:7 and 11:0 who each were administered the RAPS-K three different times, once with each level of difficulty. The primary objective is to observe the degree to which the new boards address the limitations that were present in the original RAPS boards when utilized with children. Any additional limitations or unexpected downfalls of the RAPS-K will be noted and future recommendations will be made to further improve the boards, as well as the administration and scoring process. Furthermore, this project will include twelve revised recording forms, each correlating to one of the new boards, and administration procedures that detail test information, the administration process, and recommendations to ensure the most accurate results.

CHAPTER III: METHODS

The primary objective of this project is to analyze previously collected data from the piloting of the RAPS-K boards and determine the extent to which they address the limitations identified during previous research. The effectiveness of the boards will be used to determine whether or not they are a more accurate measure for assessing problem solving abilities in the child population. Furthermore, the data will be explored to extract and identify any trends among the results to create a baseline of initial results with this assessment. In addition, the administration procedures will be modified from the original RAPS and then formalized into one document for simple comprehension and replication. Finally, the original protocols used for the RAPS were adapted to accurately reflect changes made to the picture boards.

Procedures

Three undergraduate students were trained (specifically for the purposes of this project) to analyze the responses from the RAPS-K and complete the recording forms to complete the remaining data. The data were gathered from an undergraduate class project and then entered into a database where it could be further analyzed and compared. The 26 trained undergraduate administrators were given recording forms and documented demographic information, the questions the child asked, the response to the questions asked (yes or no), the number of pictures considered, the number of pictures targeted, and the number of pictures eliminated. The three trained analysts completed the recording

forms by identifying the question type, question efficiency, total number of each question type asked, integration planning score, and question asking efficiency score.

A total of 53 neurotypical children between the ages of 4:7 and 11:0 were administered the RAPS-K three total times, one time with each level (twelve-item board, 24-item board, and 32-item board) regardless of their age. Of the 53 children, 20 were male and 33 were female. Each child was assessed with three boards, totaling to 159 RAPS-K problems in this study being analyzed.

Protocol Measures

There are six total question types divided into two main categories: constraints and guesses. Types of constraints include: Category Limited (CL), Narrowing (NR), Novel (NV), and Inefficient Constraint (IC). The two types of guesses are a Frank Guess (FG) and a Pseudo-Constraint (PC). CL are questions that target only one category on the board. NR questions narrow the field once a category has been targeted. NV questions are those that cross categories. IC questions do not narrow the field and eliminate zero questions whether answered with a yes or a no. A FG is a question that targets only one picture by explicitly asking if it is that picture. A PC is a question that sounds like a constraint but truly only targets one picture, so is therefore considered a guess. Constraint questions reflect a more advanced level of problem solving due to the fact they require mental grouping of the pictures in some way through integration. These are more effective because more than one picture is eliminated with either a ‘Yes’ or a ‘No’ response. Contrarily, guessing questions only target one picture. If answered with a ‘Yes,’ they solve the problem, but if answered with a ‘No,’ only that one picture is eliminated. The three different analysts reached 100% agreement based on discussion for

question types. Each recording form was given a total tally for each question type, total constraint questions, total guesses, and total questions asked.

An Integration Planning (IP) score is determined by analyzing the number of pictures targeted with the first question asked. The scale used in the original RAPS protocol is as follows: 1 picture targeted = IP score of 1; 2-3 pictures targeted = IP score 2; 4-5 pictures targeted = IP score of 3; 6-7 pictures targeted = IP score of 4; 8 pictures targeted = IP score of 5; & 9 or more pictures targeted = IP score of 6. This score theoretically provides insight into how much the participant planned his/her first question. It helps to determine if he/she was able to determine any patterns or categories from the beginning or if he/she blindly guessed.

Table 1.1: Integration Planning Score Scale

Number of Pictures Targeted by the First Question Twelve-item Boards	Number of Pictures Targeted by the First Question 24 and 32-item Boards	Integration Planning (IP) Score
1	1	1
2	2-3	2
3	4-5	3
4	6-7	4
5	8	5
6+	9+	6

The question asking efficiency (QAE) score is the most comprehensive measure of problem solving ability if using only one measure. For the purposes of this assessment, is utilized as the score. The QAE score is the average of the first four question

efficiencies. Question efficiencies are found by dividing the pictures targeted or pictures eliminated (whichever is smaller) by the total pictures considered and multiplying by two. The first four question efficiencies are added together and divided by four to yield the QAE score. For example, if 24 pictures were considered and a question targeted six and eliminated 18, the question efficiency would be 0.5 (6/24 = 0.25 x 2). If 32 pictures were considered and a question targeted half the board, then 16 pictures would be targeted and 16 pictures would be eliminated either way. The QAE score would be 1.0 (16/32 = 0.5 x 2) and would consequently be the highest scoring question that could be asked. The question efficiencies can be range between 0.06 and 1.0. The higher the number, the more effective the question because regardless of a 'Yes' or 'No' answer, multiple pictures are eliminated. Therefore, the higher the QAE score, the stronger the problem solving skills of the participant.

While the previous measures are used in determining scores and the participant's ability to problem solve, this projects also takes into account the overall success of the assessment in order to consider if the modifications that were made are effective given the intended population. The questions were selected based on the limiting factors observed when children were administered the original RAPS. The questions used to guide the project in measuring perceived effectiveness are as follows:

1. Did the child ask enough questions for the administrator to gather sufficient data to score?
2. Was the task completed?
3. Was the time to complete the task relatively short?

CHAPTER IV: RESULTS

This study sought to determine whether or not the revised RAPS-K boards addressed the limitations found in previous research when the original RAPS was used to assessed children. Part of this project was to make adjustments to the original RAPS recording forms to reflect the changes made the boards. The following figures show a recording form from each difficulty level.

On each recording form, the picture information was changed to reflect the categories, pictures, and color status of each picture on the specific board. This is to ensure that the administrator has a written and categorized list of all pictures on the board being used. Additionally, the lower range of the question efficiency was revised for the twelve- and 24-item boards. A range of 0.06 to 1.0 was provided for the 32-item boards on the original RAPS but because additional sizes of boards were created, the lowest possible question efficiency changed. The lowest possible question efficiency for each board was determined by using the following equation: one divided by the number of pictures on the board multiplied by two. Note that question efficiency is calculated by dividing the number of pictures targeted or eliminated (whichever is smaller) by the total pictures considered. For the first question, the smallest number of pictures considered or eliminated could be one and the total pictures considered will always be the size of the board. Therefore, the lowest range of question efficiency for the twelve-item boards is 0.17 (1/12 x 2), 0.08 (1/24 x 2) for the 24-item boards and remained the same at 0.06 (1/32 x 2) for the 32-item boards.

Figure 2.1: Recording Form for 12-Item 'Easy' Board - 12.1 (See Appendix C)

RAPS for Kids—Recording Form

BOARD 12.1

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	Y / N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.17.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2 pics = 2; 3 pics = 3; 4 pics = 4; 5 pics = 5; & 6+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 12.1			
# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
4	Sports	Baseball, Golf	Football, Basketball
4	Transportation	Train, Truck	Bus, Airplane
2	Insects	Bee	Ladybug
2	Zoo Animals	Zebra	Giraffe

Observations/Comments:

Figure 2.2: Recording Form for 24-Item 'Medium' Board - 24.1 (See Appendix C)

RAPS for Kids—Recording Form

BOARD 24.1

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	Y N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.08.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 24.1			
# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Zoo Animals	Gorilla, Zebra, Penguin, Elephant	Lion, Giraffe, Tiger, Hippo
6	Toys	Legos, Doll, Bubbles	Puzzle, Hoverboard, Fidget spinner
6	Medical Equipment	Shot, Pill, Stethoscope	Band-aid, Thermometer, Wheelchair
4	Desserts	Milkshake, Cupcake	Sundae, Popsicle

Figure 2.3: Recording Form for 32-Item 'Hard' Board - 32.1 (See Appendix C)

RAPS for Kids—Recording Form

BOARD 32.1

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.*

RAPS-K Scores	Total Constraints ☐			Total Guesses ☐			**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 32.1

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Furniture	Recliner, Bed, Chair, Desk	Couch, Drawers, Table, Bean bag
6	Technology	iPod, iPhone, TV	Game controller, iPad, Computer
6	Body Parts	Ear, Foot, Lips	Hand, Nose, Eye
4	Clothes	Shirt, Shoe	Pants, Socks
4	Sports	Football, Basketball	Baseball, Golf
4	Desserts	Cake, Popsicle	Cupcake, Cookies

It is important to note that outliers can occur outside of the specified range for each board. For example, if a child asked an inefficient constraint, a question that didn't target or eliminate any pictures, then the question efficacy would be 0, regardless of the board size. In addition to the low outlier, it is possible that a question has an efficiency greater than 1.0. Typically, the most effective question, especially at the beginning of the problem, eliminates half of the pictures, yielding a question efficiency of 1.0. While not extremely common, it is possible that a child asks a question that eliminates more than half of the board, resulting in a question efficiency higher than 1.0. The range noted on each recording form refers to the typical number of pictures targeted or eliminated with each question.

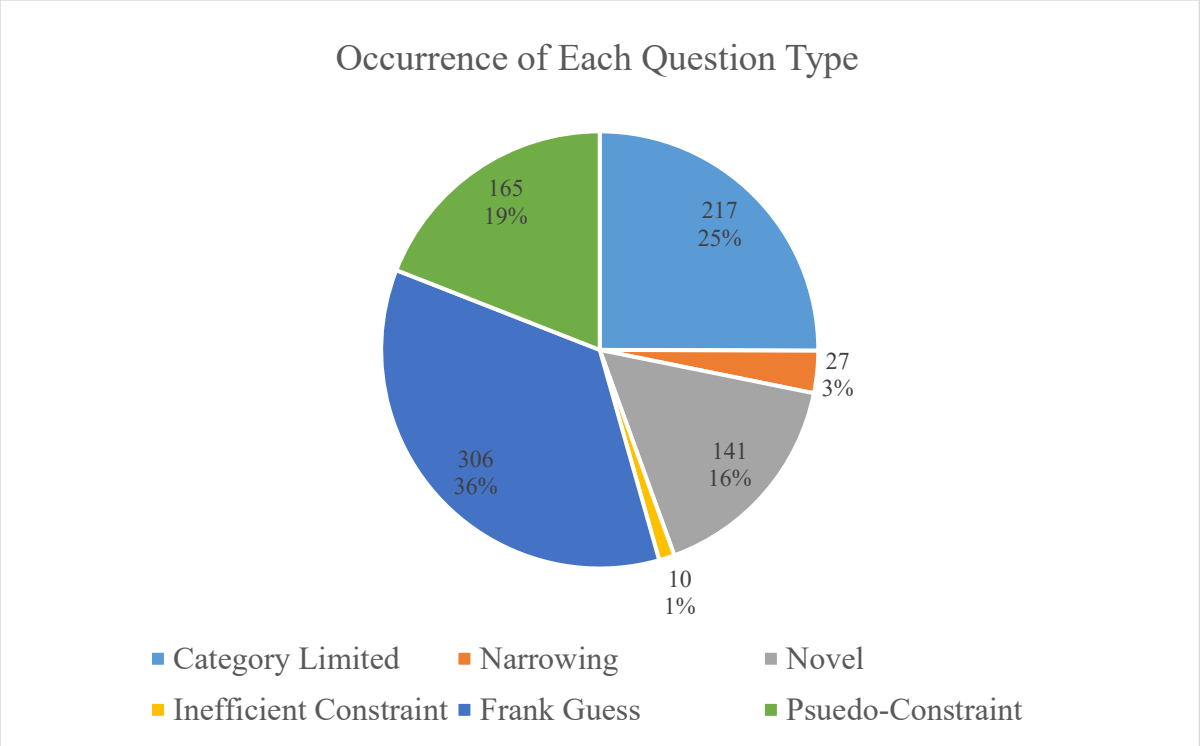
Another change made to the recording forms, specifically to the twelve-item board recording forms, was the Integration Planning (IP) score scale. Because picture stimuli decreased to twelve, the scale needed to be adjusted based on the amount of picture stimuli changing. The reasoning is the highest IP score reflects a novel question being asked, one that eliminates more than one picture and more than one category. Because the highest number of pictures eliminated with a first question (typically) is half, the most that could be eliminated on a twelve-item board is six pictures, which would yield an IP score of four. The highest possible IP score is six. A higher IP score reflects a greater ability to integrate pictures. The highest score must be able to be attained on all board sizes. Therefore, the scale was modified to a new format in which the number of picture targets directly correlates to the IP score. For example, if one picture was targeted, it would reflect an IP score of one; if three pictures were targeted, it would

result in an IP score of three; if six pictures were targeted, it would result in an IP score of six.

It should be noted that this limitation on the recording forms was not discovered until after data were initially analyzed. Therefore, all IP scores on the twelve-items boards are based on the original IP scale, so no participants achieved an IP score of five or six, even if six pictures were eliminated by the first question. It was determined that this limitation needed to be addressed nonetheless, so changes were made to the recording forms post-data analysis. Furthermore, because the IP scale is different for the twelve-item board and the 24- and 32-item board, the boards are unable to be directly compared since doing so would result in invalid data.

Upon completion of the recording forms, further analysis was conducted to find comprehensive trends across all three levels of difficulty, as well as trends among each board level. A total of 53 children between the ages of 4:7 and 11:0 were assessed. The average age of the sample was 7:7. Of the 53 children, 20 were male and 33 were female. Each child was assessed with three boards, totaling to 159 RAPS-K problems in this study being analyzed. The average administration time for one RAPS-K problem was three minutes. Administration time for all three board levels combined did not exceed 15 minutes. Of the 159 problems, there were 866 total questions asked. The mean number of questions asked per board to solve the problem was 5.45 questions. Of the 866 questions asked, 217 were CL, 27 were NR, 141 were NV, ten were IC, 306 were FG, and 165 were PC; bringing the sum to 395 total constraint seeking questions and 471 guesses.

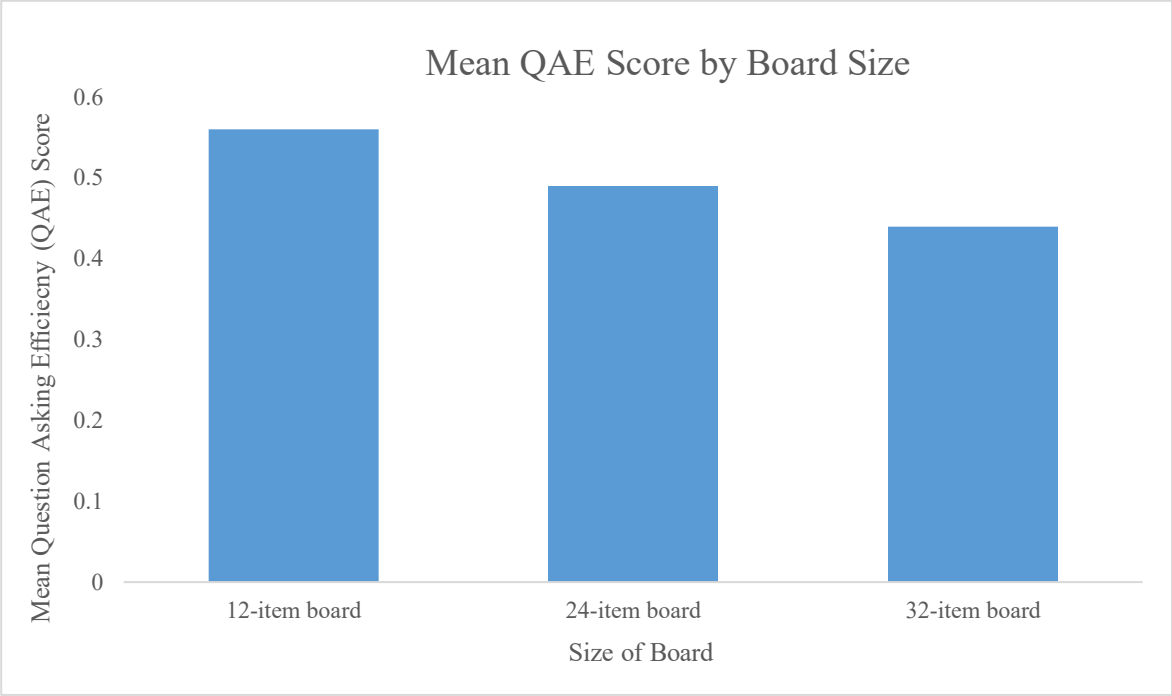
Figure 3.1: Occurrence of Each Question Type



Further analysis revealed trends among scores of each sized board. Of all 53 twelve-item boards, there was a mean of 4.7 questions asked to complete each problem. The twelve-item board yielded a mean IP score of 2.3 and a mean QAE score of 0.56, with a range of 0.14 to 0.92. A mean of 5.4 questions was needed to solve the 24-item boards. The 24-item board yielded a mean IP score of 3.6 and a mean QAE score of 0.49, with a range of 0.09 to 0.9. Of the 32-item boards, there was a mean of 6.2 questions asked to solve each problem. The mean IP score was 3.4 and the mean QAE score was 0.44, with a range of 0.07 to 0.88.

These results indicate a direct correlation between the difficulty level of the board and the number of questions required for participants to solve each problem. Because there was a greater number of pictures on each board as the level of difficulty increased, more questions were required to eliminate pictures to determine the single target picture.

Figure 4.1: Mean QAE Score by Board Size



The IP score between the 24- and 32-item boards were very similar, but both were higher than the IP score for the twelve-item boards, which showed a low demonstration of integration skills before asking the first questions.

Finally, there was an inverse correlation between the difficulty level of the board and the QAE score. As the difficulty level increased, the mean question efficiency of the first four questions decreased. This indicates that the participants had more difficulty asking effective questions when the boards were larger and had more pictures, which more than likely contributed to the need to ask more questions to solve the problems on the larger boards. This supports that the difficulty levels of the boards were valid and formulated appropriately

CHAPTER V: DISCUSSION

Scoring

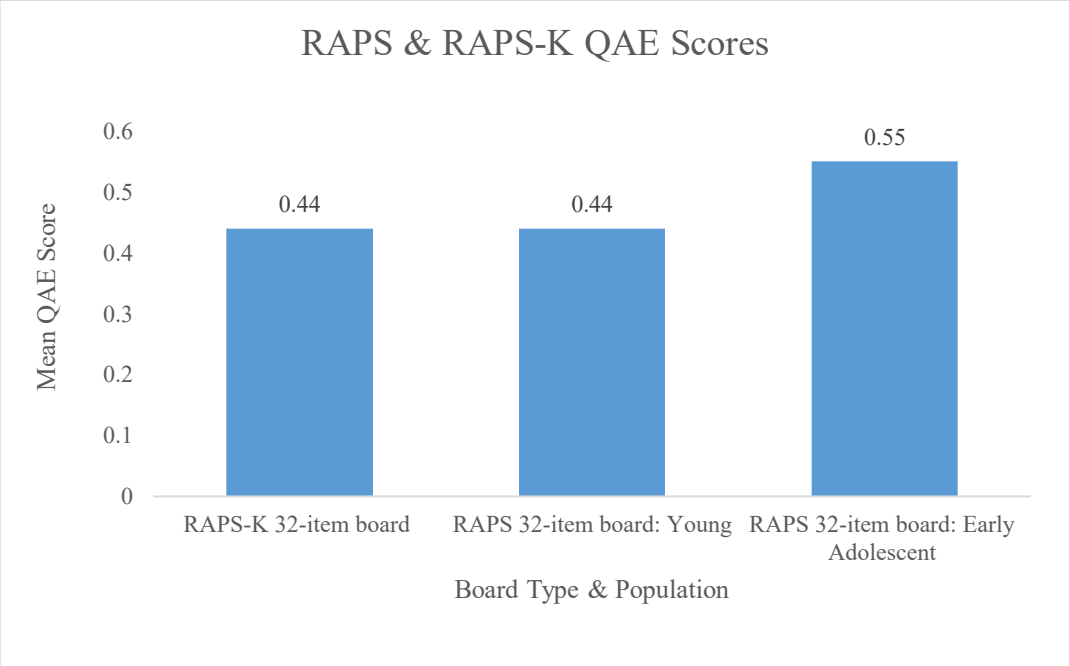
Data from this pilot study with the RAPS-K show trends indicating some boards were more difficult than others. Gathered through total number of questions asked to solve the problem, IP score, and QAE score, participants' scores were generally higher for the smaller twelve-item boards than they were for the 24- and 32-item boards. This difference in mean scores provides evidence that the boards were leveled appropriately and can be used to assess different levels of problem solving in children. For instance, a developmentally younger child may need to begin using one of the four twelve-item boards. Depending on how the child performs, the administrator can choose to advance to the 24-or 32-item boards. Because of the fast-paced rate of a child's development, two children who are only a few years apart in age may have a completely different set of problem solving skills and an overall different level of executive functioning. The board levels allow the RAPS-K to be more compatible with providing services to a larger age range.

Comparing RAPS-K Scores with RAPS Administration to Children

When Smith (2015) used the RAPS to assess children, participants were divided into three groups based on their developmental age. The three groups were labeled: Young, Early Adolescent, and Adolescent. The Young group was comprised of children ages 7:0 to 9:0 while the Early Adolescent group was comprised of children ages 10:0 to

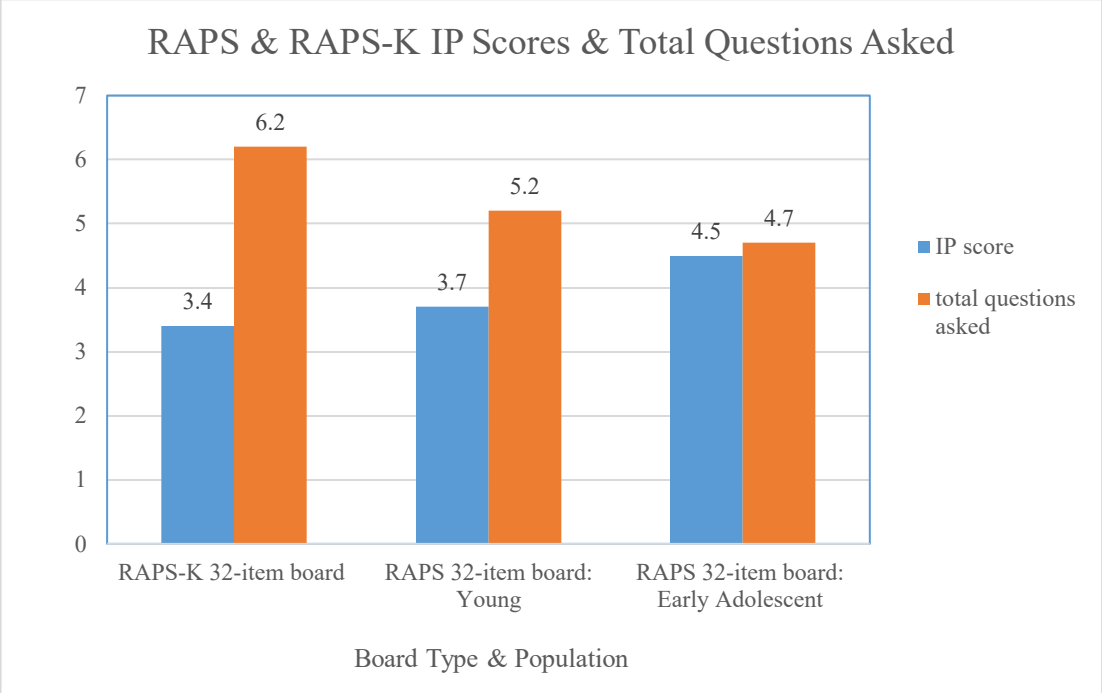
13:0. As previously mentioned, the age range for this study using the RAPS-K was between the ages of 4:7 and 11:0 with a mean age of 7:7. Due to the overlap of participant age in both studies, results can be compared to determine any similarities or differences between assessments. While the children in Smith's study were given the original RAPS, which was only comprised of 32-item boards, their results can be compared to the results from the 32-item boards on the RAPS-K. Comparison of total questions asked to complete the task, IP score, and QAE score is presented in the following figures.

Figure 5.1: RAPS & RAPS-K QAE Scores



As shown in the figures above, the mean QAE score of the RAPS-K 32-item boards and the RAPS boards with the Young group was identical at 0.44. The mean QAE score of the RAPS boards with the Early Adolescent group was higher at 0.55.

Figure 5.2: RAPS & RAPS-K IP Scores & Total Questions Asked



This group's ability to ask overall more effective questions is to be expected due to the older developmental age of the participants. When examining the mean IP scores across the three groups, the RAPS-K participants scored the lowest with a mean of 3.4 while the RAPS Early Adolescent group scored the highest with a mean of 4.5. This reveals that the early adolescents showed the most competency with integrating pictures before asking their first question compared to their younger counterparts on the same assessment, as well as the participants given the RAPS-K.

Finally, the mean total questions asked to complete the task and identify the target picture were inversely correlated with the mean IP score. This indicates that RAPS-K participants required more questions to identify the target picture than did either group of the RAPS participants. As with other measures, the Early Adolescent group performed

the best and only required a mean of 4.7 questions to complete the task, compared to a mean of 5.2 for the young RAPS group and a mean of 6.2 for the RAPS-K group.

While the RAPS-K yielded a lower mean IP score and higher mean total questions asked, it not presumed to indicate that it is too difficult or ineffective. It was with purposeful intent to expand this project to younger children in order to determine the potential range of population. Including younger children in the study was anticipated to generate lower scores due to the lower level of cognitive development and assumed lower problem solving ability. With the minimum age tested with the RAPS at 7:0 years and the mean age being tested with the RAPS-K at 7:7 years, it is evident that the RAPS-K had a much younger population. Thus, RAPS-K data was pulled only from the 32-item boards for this comparison. In theory, young children would not be administered the 32-item board because it is the most difficult level. From evidence stating that the boards are leveled appropriately, children, regardless of age, would score better on the easier twelve- or 24-item boards compared to the 32-item boards.

Effectiveness of the RAPS-K

While analyzing the scores revealed trends useful for validating administration, the primary objective of this study was to render the RAPS-K effective or ineffective based on its ability to address the limitations found when administering the RAPS to children. The questions used to guide this discussion were as follows:

1. Did the child ask enough questions for the administrator to gather sufficient data to score?
2. Was the task completed?
3. Was the time to complete the task relatively short?

In order to properly gather the data required to score a child's problem solving ability, the child must ask enough questions to determine a QAE score. A total of four questions must be asked in order to gather question efficiencies that are averaged to generate the QAE score. If the child solves the problem with fewer than four questions through guessing or if he/she does not complete the task and a minimum of four questions are not asked, a score is not able to be given. However, if a child is not able to ask yes or no questions that are relevant to the pictures on the board, or if he/she only uses guesses for the limited amount of questions, this could still give insight into a child's problem solving and cognitive ability.

Of the 159 RAPS-K problems administered, 23 were deemed invalid due to a participant who asked fewer than four questions. This accounts for 14.5% of the problems in this study. Observations recorded by the administrators indicated that some of the children did not understand the purpose of the test and were not able to grasp what they were being asked to do. Other children were observed to get distracted and were unable to finish the task. Upon further analysis, it was discovered that some administrators were unaware of the role they played in making sure enough questions were asked. For example, if a child is only asking guess questions and happens to guess the target picture in the first three questions, the administrator can still answer "No" and change the chosen picture, only answering "Yes" when at least four questions have been asked. Upon examining some of the recording forms, it was evident that the child had guessed the initial chosen picture within the first three questions and the administrator failed to change the picture to warrant more questions from the child. This limitation

caused the inability to score 14.5% of tests and will be addressed through further explanation and clarification in the attached administration manual.

Based on the amount of data missing due to less than four questions being asked before the problem was solved, additional instruction was incorporated into the administration manual to address this issue. Specifically, future administrators are instructed to change the target picture if the child solves the problem in less than four questions. For example, if the target was 'milkshake' and the child guessed, "Is it the milkshake?" for their first question, the administrator would answer "no" and select a different target (i.e. tiger) to move forward with the problem.

The second question used to judge the perceived effectiveness of the RAPS-K is "Was the task completed?" If the task was unable to be completed, then it was unattainable for the participant and therefore automatically deemed ineffective. While not all tasks had four questions asked, 100% of the 159 tasks were fully completed, meaning that the target picture was successfully identified by the participant. This suggests that the task was attainable for all ages that were assessed.

The final question used to gauge perceived effectiveness was the amount of time it took to administer the RAPS-K. One of the primary reasons to create the RAPS was the need for an assessment that did not take too long to administer. When working with individuals who have suffered from a brain injury or have other cognitive impairments, attention span is often negatively affected. This deficit can be further amplified when working with children. If an assessment is too long to effectively maintain an individual's attention, it increases the risk of distraction and the participant's inability to finish the task. Similarly, if a task is too long, the participant's motivation will decrease and

possibly affect their performance. While an exact administration time was not recorded for each board, average times were observed. The average administration time for one board was three minutes. In comparison to other problem solving assessments such as the RPM, this is a relatively short assessment. On average, the screening and three RAPS-K problems can be administered in less than twenty minutes.

Conclusion

In summary, 159 recording forms were completed and analyzed to determine trends in scores. Additionally, three factors (enough questions asked, task completion, and efficient administration) were used to guide this study to determine the perceived effectiveness of the RAPS-K with this specific population of neurotypical children between the ages of 4:7 and 11:0. Results conclude that there is potential for using these boards to assess a child's problem solving ability. The modified boards and recording forms did address limitations that were revealed when the RAPS was used to assess children. While the RAPS-K has been shown to effectively gather data, there is not a precedent of scores to which these can be compared. The aim of this study was not to create a set of normative scores or a range of what is considered to be 'passing,' but rather to create a baseline that presents data from the initial use and piloting of this assessment.

Future Recommendations

Based on this research, evidence supports the RAPS-K boards were categorized and labeled with reasonable levels of difficulty. When used in the future, an administrator should choose a board based on the child's developmental age and cognitive ability. For a broadened approach, an administrator should begin with the twelve-item 'easy' board and

if the child is able to complete the task by asking effective questions (not only utilizing guess questions), the administrator should move on the 24-item 'medium' board, and finally to the 32-item 'hard' board. It is recommended that the participant be given a task from each board size three times and that the average of all three scores should be the final score that indicates his/her problem solving ability. It is also recommended that during future administration, the administrator use the modified scale to determine IP score for the twelve-item boards. Although this limitation was realized after analysis in this study, the modified recording forms for all twelve-item boards use this updated scale and should be utilized.

It was determined that the RAPS-K was effective in gauging problem solving ability with this specific population. These modified boards, along with the recording forms and administration manual, should be piloted with children who have been diagnosed with autism spectrum disorder (ASD). Just as the RAPS was intended for use with individuals with compromised executive functioning skills, the RAPS-K is intended for use with children who are both typically developing and children who have cognitive deficits. These data were gathered only from neurotypical children in order to get a standard baseline for the child population. Results between diagnosed and typically developing children should be compared in order to determine trends and effectiveness of this assessment with a new population.

Future studies should focus on collecting a larger sample of normative data for neurotypical children in order to investigate the validity and reliability of these leveled boards for a broader population. Limitations for this project included a small sample with missing data points, lack of rigor with administration protocols due to lack of a

formalized administration manual, and unadjusted scales to evaluate integration planning ability for the new twelve-item boards. Therefore, future research should endeavor to build on the information included in this document as well as test the effectiveness of the administration manual included in Appendix C. Additionally, since the purpose of this research is to eventually apply the RAPS-K to children with cognitive deficits, researchers should engage in preliminary data collection with these populations.

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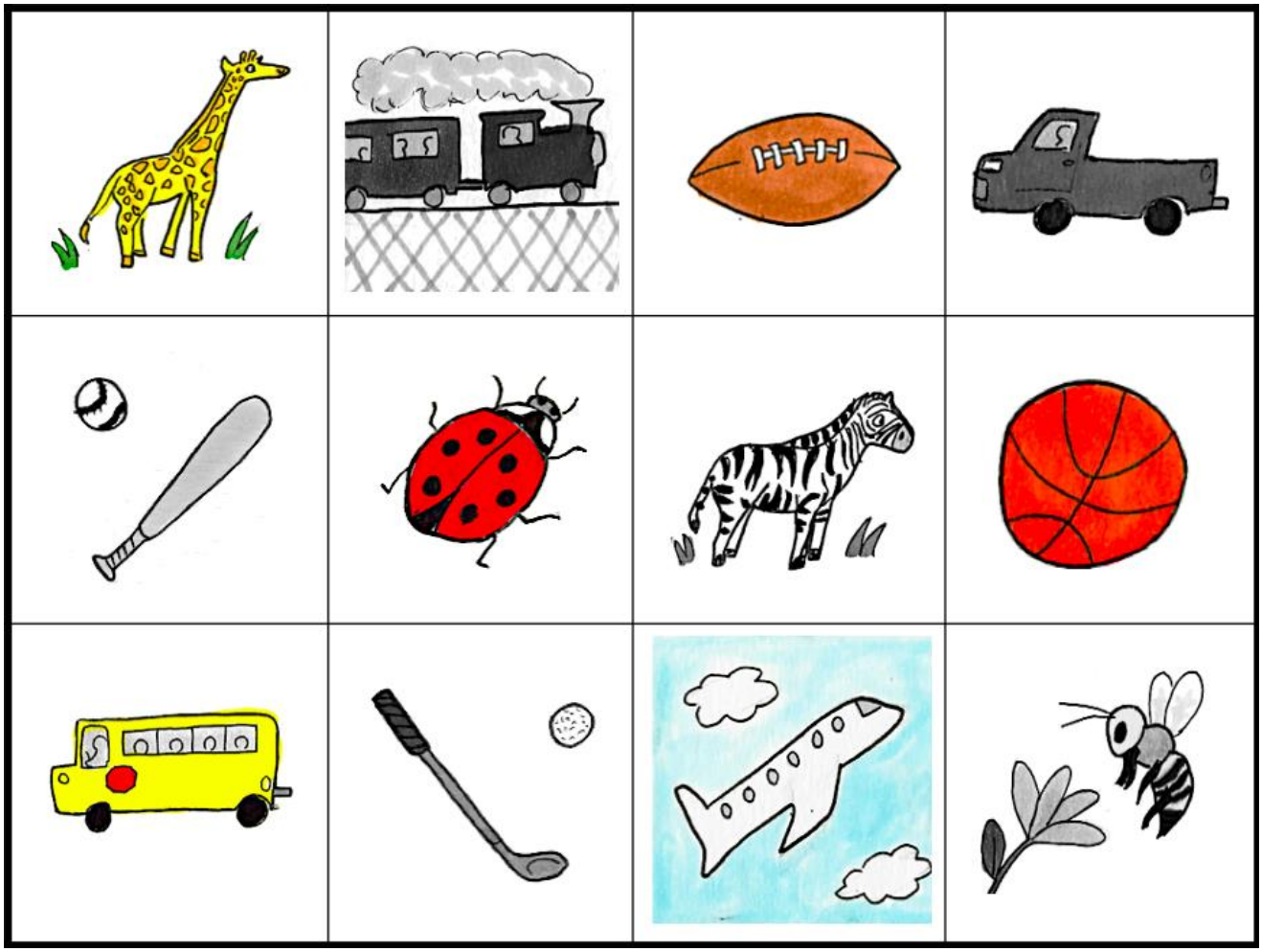
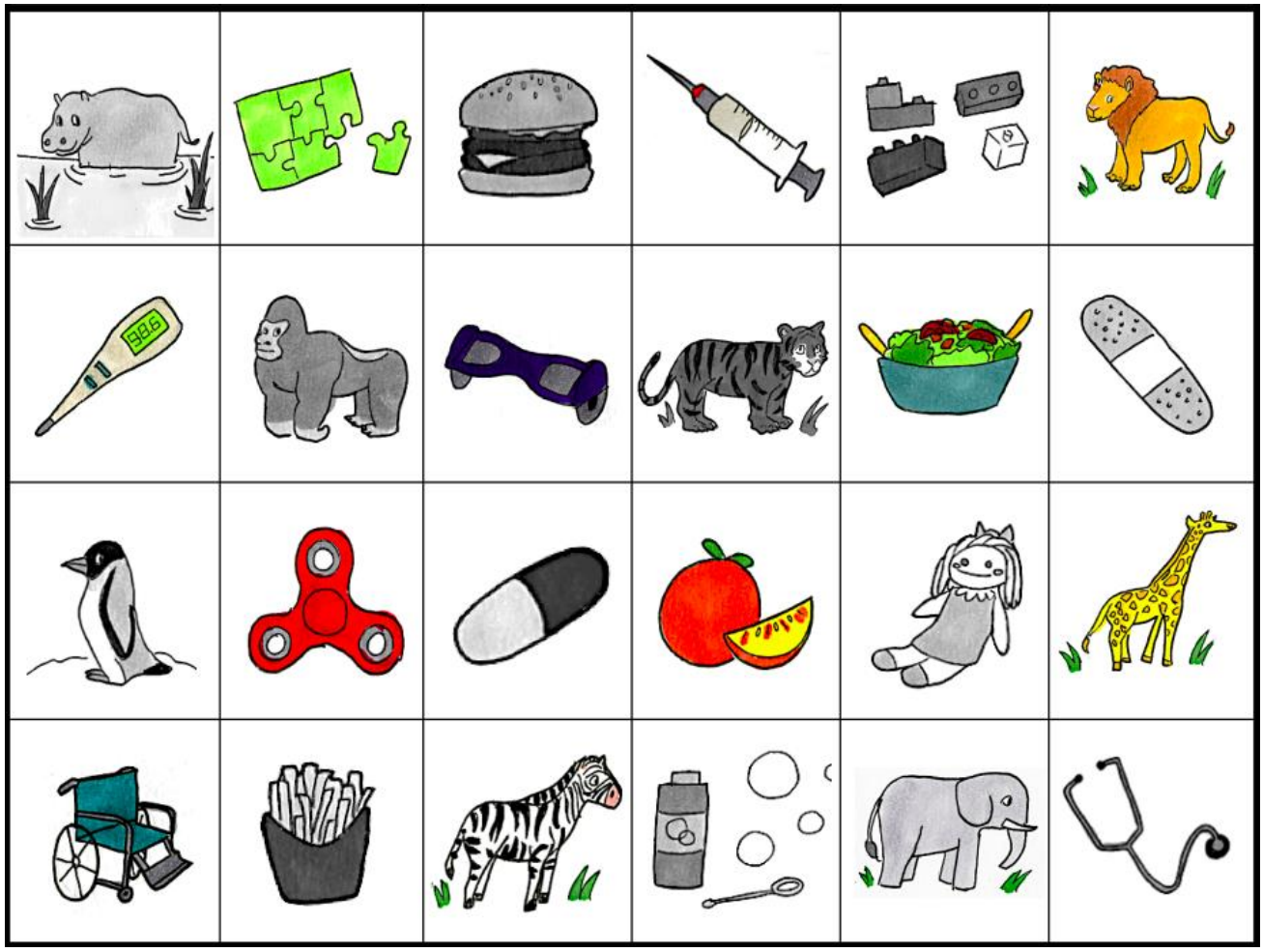
APPENDIX A

RAPS-K Board 12.1



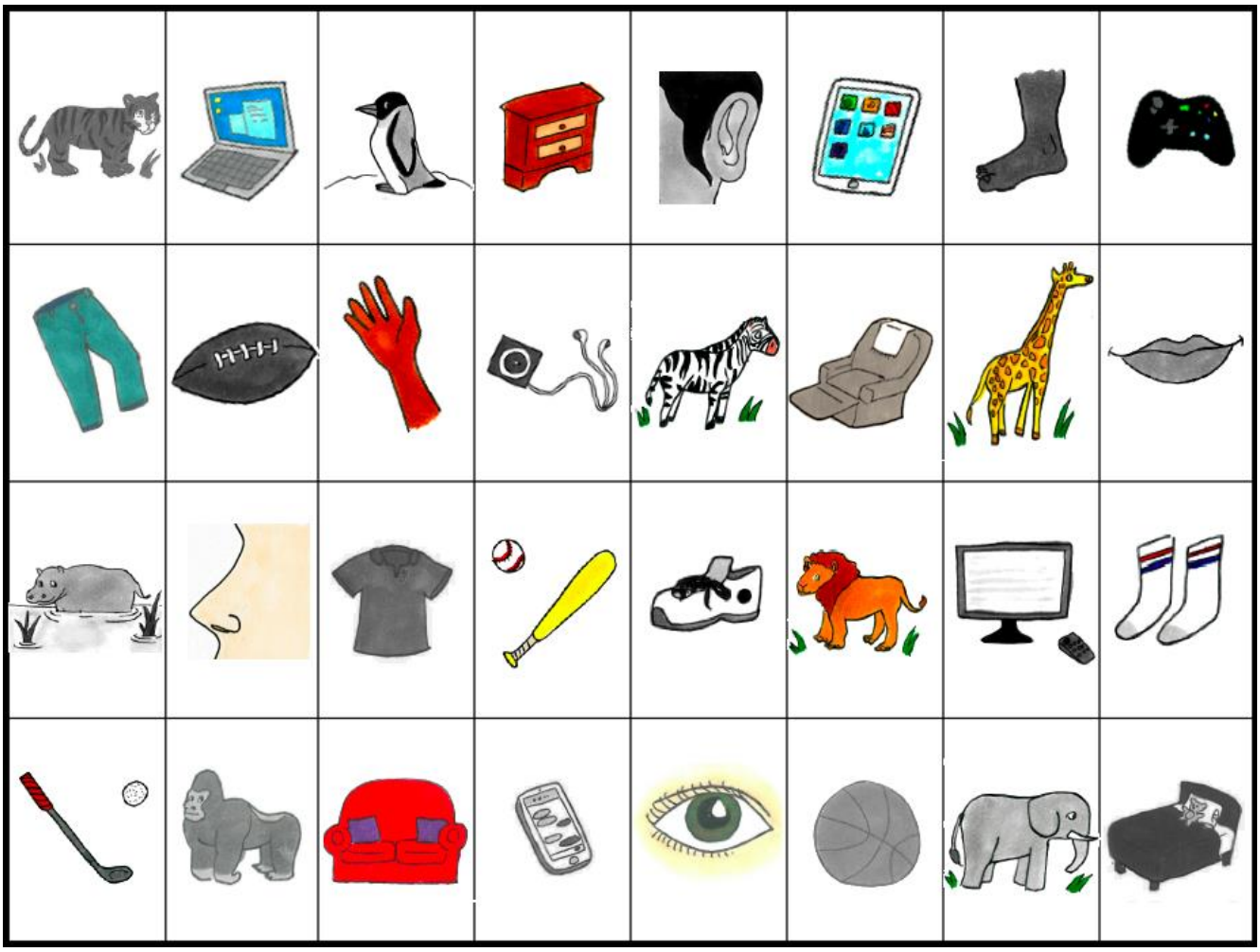
Note. Artwork by Rachel Peavler.

RAPS-K Board 24.1



Note. Artwork by Rachel Peavler.

RAPS-K Board 32.1



Note. Artwork by Rachel Peavler.

APPENDIX B

RAPS-K Example Screening

Rapid Assessment of Problem Solving for Kids—Screening

Picture Recognition & Oral Naming

Instructions: ***"I am going to show you some picture cards. You tell me what the picture is called. You get to keep each picture you get right and I keep any other ones. If you have more than me at the end, you win!"***

For any pictures the child cannot name, place the unknown picture in an array of four and ask "Can you show me the ____?" Make not of any pictures that were correctly identified with a check mark (✓) in the +/- column.

	Colored Pictures	+/-		Black & White Pictures	+/-	Comments
01	Lion	+	16	Gorilla	+	
02	Nose	+	17	Laptop	+	
03	Pants	+	18	Baseball bat	+	
04	Orange	+	19	Shoe	+	
05	Couch	+	20	Hand	+	
06	Basketball	+	21	Bubbles	+	
07	iPad	+	22	Hamburger	+	
08	Puzzle	+	23	Bed	+	
09	Trumpet	+	24	Shot	+	
10	Thermometer	+	25	Piano	+	
11	Spider	+	26	Boat	+	
12	Watch	+	27	Glasses	+	
13	Tree	+	28	Flowers	+	
14	Hammer	+	29	Bee	+	
15	Train	+	30	Shovel	+	
	Subtotal	15		Total*	30	

*Score of 24 (80%) or higher passes.

Yes/No Question Formulation

Instructions: ***"I want to hear you ask me some questions that I can answer yes or no. Look at this board*** (point to Screening board A or B) ***and try to figure out which picture I'm thinking of by asking me some questions that I can answer yes or no. Go ahead and ask me a question when you are ready."***

The child passes this portion if he/she can independently formulate 2 to 4 questions that can be answered yes or no. Write their questions below.

Question 1: Can you wear them?

Question 2: Are they black and white?

Question 3: Are they the boots?

Question 4: _____

APPENDIX C

RAPS-K Recording Forms

RAPS for Kids—Recording Form

BOARD 12.1

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	Y N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.17.*

RAPS-K Scores	Total Constraints ☐ Category Limited	Narrowing	Novel	Inefficient Constraint	Total Guesses ☐ Frank Guess	Pseudo-Constraint	Total Questions
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2 pics = 2; 3 pics = 3; 4 pics = 4; 5 pics = 5; & 6+ pics = 6	

QE for Question #	1	2	3	4	QAE
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 12.1

# of ITEMS	CATEGORY	BLACK & WHITE	COLOR
4	Sports	Baseball, Golf	Football, Basketball
4	Transportation	Train, Truck	Bus, Airplane
2	Insects	Bee	Ladybug
2	Zoo Animals	Zebra	Giraffe

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 12.2

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	Y N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.17.*

RAPS-K Scores	Total Constraints ☐ Category Limited	Narrowing	Novel	Inefficient Constraint	Total Guesses ☐ Frank Guess	Pseudo-Constraint	Total Questions
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2 pics = 2; 3 pics = 3; 4 pics = 4; 5 pics = 5; & 6+ pics = 6	

QE for Question #	1	2	3	4	QAE
Question Asking Efficiency Score*					

**Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*

Information for Board 12.2			
# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
4	Instruments	Drum, Flute	Guitar, Trumpet
4	Toys	Doll, Legos	Fidget spinner, Hoverboard
2	Food	French fries	Hotdog
2	Furniture	Desk	Recliner

RAPS for Kids—Recording Form

BOARD 12.3

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.17.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2 pics = 2; 3 pics = 3; 4 pics = 4; 5 pics = 5; & 6+ pics = 6	

	QE for Question # 1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 12.3			
# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
4	Medical Equipment	Shot, Band-aid	Wheelchair, Thermometer
4	Dessert	Ice cream cone, Cake	Cupcake, Cookies
2	Pets	Cat	Dog
2	Beach	Sand bucket	Sandcastle

RAPS for Kids—Recording Form

BOARD 12.4

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.17.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2 pics = 2; 3 pics = 3; 4 pics = 4; 5 pics = 5; & 6+ pics = 6	

	QE for Question # 1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 12.4

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
4	Tools	Saw, Rake	Shovel, Screwdriver
4	Technology	TV, iPhone	Computer, Game controller
2	Clothes	Shoe	Dress
2	Plants	Flowers	Palm tree

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 24.1

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.08.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

	QE for Question # 1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 24.1

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Zoo Animals	Gorilla, Zebra, Penguin, Elephant	Lion, Giraffe, Tiger, Hippo
6	Toys	Legos, Doll, Bubbles	Puzzle, Hoverboard, Fidget spinner
6	Medical Equipment	Shot, Pill, Stethoscope	Band-aid, Thermometer, Wheelchair
4	Desserts	Milkshake, Cupcake	Sundae, Popsicle

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 24.2

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.08.*

Total Constraints ☐ Total Guesses ☐

RAPS-K Scores	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	**Total Questions**
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

	QE for Question # 1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 24.2

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Clothes	Socks, Bow, Pants, Coat	Shirt, Dress, Scarf, Shoe
6	Body Parts	Eye, Hand, Nose	Lips, Ear, Foot
6	Transportation	Sailboat, Airplane, Bus	Truck, Train, Car
4	Sports	Soccer, Bowling	Tennis, Football

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 24.3

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White
❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.08.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

	QE for Question # 1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 24.3

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Tools	Wrench, Hammer, Saw, Shovel	Lawnmower, Rake, Screwdriver, Axe
6	Technology	iPhone, Computer, Game controller	iPod, TV, iPad
6	Accessories	Watch, Glasses, Earrings	Bracelet, Necklace, Ring
4	Musical Instruments	Drum, Violin	Saxophone, Guitar

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 24.4

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.08.*

Total Constraints ☐ Total Guesses ☐

RAPS-K Scores	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	**Total Questions**
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 24.4

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Furniture	Drawers, Bed, Recliner, Chair	Desk, Table, Bean bag, Couch
6	Food	Eggs, Hotdog, Hamburger	Pizza, Salad, French fries
6	Insects	Grasshopper, Ladybug, Bee	Cockroach, Ant, Spider
4	Plants	Palm tree, Evergreen	Grass, Flowers

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 32.1

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		**Total Questions**
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 32.1

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Furniture	Recliner, Bed, Chair, Desk	Couch, Drawers, Table, Bean bag
6	Technology	iPod, iPhone, TV	Game controller, iPad, Computer
6	Body Parts	Ear, Foot, Lips	Hand, Nose, Eye
4	Clothes	Shirt, Shoe	Pants, Socks
4	Sports	Football, Basketball	Baseball, Golf
4	Desserts	Cake, Popsicle	Cupcake, Cookies

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 32.2

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.*

Total Constraints ☐ Total Guesses ☐

RAPS-K Scores	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	**Total Questions**
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 32.2

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Pets	Cat, Parrot, Rabbit, Dog	Pig, Horse, Fish, Hamster
6	Toys	Hoverboard, Bubbles, Legos, Doll	Puzzle, Fidget Spinner
6	Transportation	Bus, Sailboat, Airplane	Train, Car, Truck
4	Food	French fries, Hamburger	Hotdog, Pizza
4	Clothes	Dress, Scarf	Bow, Coat
4	Furniture	Chair, Drawers	Recliner, Bed

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 32.3

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White
❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	Y N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.*

RAPS-K Scores	Total Constraints ☐				Total Guesses ☐		Total Questions
	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

	QE for Question # 1	2	3	4	QAE
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 32.3

# of ITEMS	CATEGORY	BLACK & WHITE	COLOR
8	Musical Instruments	Flute, Violin, Saxophone, Piano	Guitar, Harmonica, Trumpet, Drum
6	Medical Equipment	Stethoscope, Band-aid, Pill	Thermometer, Wheelchair, Shot
6	Accessories	Bracelet, Necklace, Watch	Glasses, Earrings, Ring
4	Beach	Umbrella, Waves	Goggles, Floaties
4	Furniture	Desk, Chair	Bean bag, Table
4	Desserts	Ice cream sundae, Milkshake	Pie, Ice cream cone

Observations/Comments:

RAPS for Kids—Recording Form

BOARD 32.4

Name:_____ **Date of Testing:**_____

Ethnicity: (Please check one box.) ❒ Arab ❒ Asian/Pacific Islander ❒ Black ❒ Caucasian/White ❒ Hispanic ❒ Latino ❒Native American ❒ Multiracial ❒ Other

Gender M F **D.O.B.** _____ **Age** (yrs:mos) ____:____ **Problem:** ☐ 1 ☐ 2 ☐ 3

Question Asked (Write each question in the space provided below.)	**Y N**	**Question Type**	**# Pictures Considered**	**# Pictures Targeted**	**# Pictures Eliminated**	**Question* Efficiency**
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

**QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.*

Total Constraints ☐ Total Guesses ☐

RAPS-K Scores	Category Limited	Narrowing	Novel	Inefficient Constraint	Frank Guess	Pseudo-Constraint	**Total Questions**
Types of Questions							

		IP Score
Integration Planning Score	**FIRST question** targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	

QE for Question #	1	2	3	4	**QAE**
Question Asking Efficiency Score* **Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.*					

Information for Board 32.4

# of ITEMS	**CATEGORY**	**BLACK & WHITE**	**COLOR**
8	Tools	Lawnmower, Screwdriver, Shovel, Wrench	Hammer, Saw, Rake, Axe
6	Plants	Shrub, Flowers, Tree	Palm tree, Evergreen, Grass
6	Insects	Grasshopper, Ladybug, Bee	Spider, Ant, Cockroach
4	Beach	Sand bucket, Starfish	Sandcastle, Seashell
4	Sports	Volleyball, Soccer	Tennis, Bowling
4	Food	Orange, Eggs	Carrots, Salad

Observations/Comments:

APPENDIX D

Administration Manual

Rapid Assessment of Problem Solving for Kids Administration and Scoring Manual

Overview

Purpose for Administration of the RAPS-K

The Rapid Assessment of Problem Solving for Kids (RAPS-K) tests problem solving skills in children. This assessment is based on the Rapid Assessment of Problem Solving (RAPS) (Marshall & Karow, 2008) but is more child-friendly and reliable for a younger population. The RAPS-K is not intended to diagnose any disorder or disability, but only to identify deficits in cognitive ability, specifically the executive functioning skill of problem solving. The results of this assessment can be used to measure progress in a child's problem solving ability over time and to document patterns of the way in which a child solves problems.

Population Intended for this Evaluation

The RAPS-K is primarily intended for children ages 4:0 to 17:11. The original RAPS was created to assess adults ages 18 years and older. While this assessment is specifically catered to the child population, it can theoretically be used with any age. However, some of the images used reflect items that may be more recognizable by a younger generation.

Materials Needed

This assessment is composed of 12 total boards: 12.1, 12.2, 12.3, 12.4, 24.1, 24.2, 24.3, 24.4, 32.1, 32.2, 32.3, and 32.4. The boards are grouped into three categories of four based on level of difficulty. All 12-item boards are categorized as 'easy,' 24-item boards are 'medium,' and 32-item boards are 'hard.' There are also 12 recording forms, each corresponding to a specific board, that are used as the primary test protocols. Additionally, there is one screening protocol, along with a stack of 30 picture cards and two screening boards, labeled 'A' and 'B'. Finally this Administration and Scoring Manual explains appropriate purposes and procedures of this assessment.

Time Required for Administration

Most children can complete three boards in 10 - 20 minutes. A single board typically takes approximately 5 minutes to complete, but depending on a child's diagnosis, problem solving ability and attention to the task, administration time can differ. Additionally, the number of board levels that a child is given based on his/her performance will influence total administration time.

Best Environment

The testing environment should be comfortable, welcoming, and laid-back. This assessment was created to mimic a game and should be treated as such. The purpose of this is to reduce test anxiety and allow the child to feel more relaxed when taking the assessment so that stress or frustration do not affect results. This assessment can be given at a table or on the floor, whichever is most comfortable for the child. The administrator can sit across from or adjacent to the child. This test should be given in a quiet and relaxed environment with limited distractions.

Prompts and Probes

The administrator may provide oral prompts and restate the instructions as often as needed based on the child's verbal request or on the administrator's judgement if the child's behavior or nonverbal cues indicate confusion or misunderstanding.

Screening Procedures

The RAPS-K screening provided with the assessment is used primarily to ensure that a child has the necessary skills required to complete the assessment. A child must be able to identify common pictures, most of which are STEAM (science, technology, engineering, arts, mathematics) vocabulary, and be able to questions that can be answered with a 'Yes' or 'No' response.

Instructions for Task One

Standardized instructions following the RAPS-K protocol are presented on the screening form and will follow the following format for the "Picture Recognition & Oral Naming" section:

> "I am going to show you some picture cards. You tell me what the picture is called. You get to keep each picture you get right and I keep any other ones. If you have more than me at the end, you win!"

Begin with a stack of 30 picture cards and show the child one card at a time. Half of the cards are black and white and the other half are in color. Cards do not have to be in the same order as listed on the screening form but it may make administration time quicker if they are. Mark a '+' for every image a child is able to correctly identify and orally name. If a child is unable to identify an image, place that picture card with three others in an array of four and ask the child, "Can you show me the _____?" The child only has to point to the correct image for it to be counted as a correct response. Mark a '-' if a child is still unable to identify an image or if he/she chooses an incorrect image in response to your question.

Only 24 correctly named images (80%) are required for the child to pass and proceed to the next task.

Instructions for Task Two

Standardized instructions following the RAPS-K protocol are presented on the screening form and will follow the following format for the "Yes/No Question Formulation" section:

> "I want to hear you ask me some questions that I can answer yes or no. Look at this board (point to Screening board A or B) and try to figure out which picture I'm thinking of by asking me some questions that I can answer yes or no. Go ahead and ask me a question when you are ready."

Begin with showing the child either board A or board B. Choose a picture but do not tell the child which image you chose. Record all questions that the child asks, even if they are not questions that can be answered with a 'Yes' or 'No' response or questions that are not appropriate to the board presented. The child passes the screening if he/she is able to ask between two and four questions that can be answered with a 'Yes' or 'No' response. If the child wishes to complete the task by asking more questions in order to guess the target picture, then the task can be completed.

Assessment Procedures

The child should be given three 12-item boards, or 'tasks,' from the easy level. The scores from all three should be averaged to generate a mean score. After all three 12-item boards have been completed, three 24-item boards should be given for the medium level and so forth until the child has completed all three levels or until he/she is only using guess questions. If a child is only using guess questions and not showing any use of constraint questions, it shows limited problem solving skills and it can be assumed he/she will use the same strategy with all board levels. If a child solves the problem by asking constraint questions, then the administrator should continue giving all three board levels.

Instructions

The RAPS-K begins with the administrator selecting three 12-item boards. All children will start at the 'easy' level. One board, or 'task,' is given at a time. The administrator selects the recording form that matches the board being used and completes the demographic information such as name, gender, ethnicity, age, date of evaluation, and date of birth at the top of the form. The administrator then selects an image from the board to be the target image but does not tell the child what the image is. Instructions should be read aloud to the child exactly as follows:

> "We are going to play a question-asking game. I am thinking of one of these pictures (administrator gestures to the pictures) and your job is to figure out which one it is. The way to do this is to ask me questions that I can answer "Yes" or "No." You can ask me any question you want so long as I can answer it "Yes" or "No." Try to ask as few questions as possible. When you are ready, go ahead and ask your first question."

Before each question is asked, the administrator should record the number of pictures considered in the appropriate column. This should always be the size of the board for the first question. For example, when using a 24-item board, the child will always be considering all 24 pictures when asking his/her first question. Once the child asks a question, the question should be recorded exactly as asked and the administrator should respond by saying 'Yes' or 'No.' Picture covers should be used to cover the pictures that were eliminated. If it is unclear which pictures were targeted with a question, the child should be asked specify or point to which pictures they think the question eliminated. The administrator should then record a 'Y' if the answer to the child's question was yes, and a 'N' if the answer was no. The number of pictures targeted is dependent on the number of pictures the question targeted. The number of pictures eliminated depends on whether the answer was yes or no, essentially how many pictures were covered up. Repeat this process for every question the child asks.

Determining Question Type

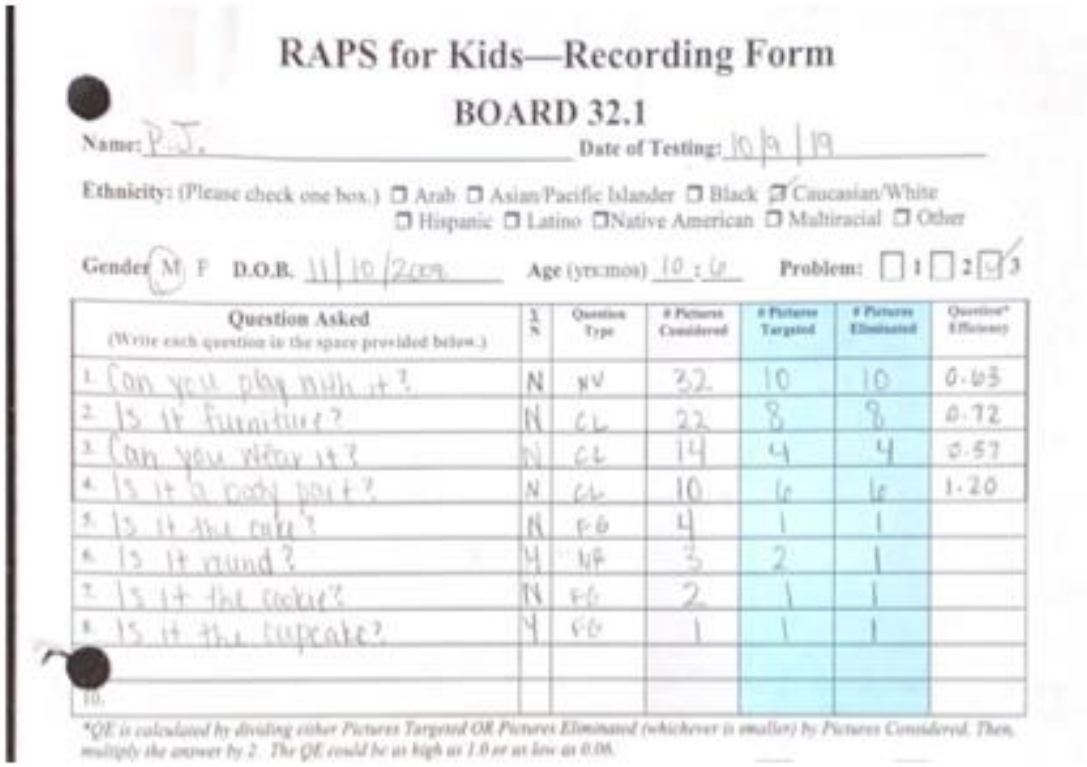
The administrator will also determine and record the type of question each time one is asked. There are six total question types that are divided into two overarching categories: constraints and guesses. Constraints are questions that narrow the field of pictures considered by eliminating two or more pictures. Guesses are questions that only target one picture. The definition of each specific question type can be seen in the chart below.

Question Types

CONSTRAINT	**KEY**	**EXAMPLE**
Category Limited	CL	Question that targets only one category on the board (i.e. *Is it a food? Do you wear it?*)
Narrowing	NR	Question that narrows the field once a category has been targeted (i.e. *Is it an animal that lives in the zoo?*)
Novel	NV	Question that crosses categories (i.e. *Is it in color? Is it on the top half?*)
Inefficient Constraint	IC	Question that does not narrow the field and eliminates no pictures whether answered with 'yes' or 'no' (i.e. *Is it an instrument that you can play?*)
GUESS	**KEY**	**EXAMPLE**
Frank Guess	FG	Question that targets only one pictures by explicitly asking if it is a target picture (i.e. *Is it the cake?*)
Pseudo-Constraint	PC	Question that sounds like a constraint but only targets only one picture (i.e. *Does it move on tracks?*)

Solving the Problem

The task is solved when the child narrows the board down to two or three pictures or when they solve the problem by guessing the correct picture. If the child wishes to keep playing until the problem is solved, he/she is able to do so. Once the task is complete and the child narrows the options to two or three pictures or guesses the image, the administrator should draw a red line under that final question to indicate the end of the task.



RAPS for Kids—Recording Form

BOARD 32.1

Name: P.J. Date of Testing: 10/9/19

Ethnicity: (Please check one box.) ☐ Arab ☐ Asian/Pacific Islander ☐ Black ☑ Caucasian/White ☐ Hispanic ☐ Latino ☐ Native American ☐ Multiracial ☐ Other

Gender M F D.O.B. 11/10/2009 Age (yrs:mos) 10:0 Problem: ☐ 1 ☐ 2 ☑ 3

Question Asked (Write each question in the space provided below.)	Y/N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1. Can you play with it?	N	NV	32	10	10	0.63
2. Is it furniture?	N	CL	22	8	8	0.72
3. Can you throw it?	N	CL	14	4	4	0.57
4. Is it a cozy you+?	N	CL	10	6	6	1.20
5. Is it the cake?	N	SO	4	1	1	
6. Is it round?	Y	NF	3	2	1	
7. Is it the cookie?	N	SO	2	1	1	
8. Is it the cupcake?	Y	SO	1	1	1	
9.						
10.						

*QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.

In Cases of Early Guessing – Changing the Target Picture

In order to be effectively scored, the child needs to ask at least four questions. If the child only uses guesses to solve the problem and guesses the target picture in less than four questions, then the administrator should answer 'No' and change the picture in order to ensure the child uses at least four questions. After four questions have been asked, the administrator can answer 'Yes' to any of the guesses and end the task, so long as the child is only using guesses. Subsequently, the administrator should end the task after ten questions have been asked in order to reduce the risk of frustration, unless the child wishes to complete the task.

Scoring

An administrator is able to gather information about a child's problem solving skills using three different types of data. All the data can be determined through scoring on the recording form.

Total Questions Asked

The first way to score this assessment is by calculating the total number of questions asked in order for the child to solve the problem. Typically, the lower the number of questions required to solve the problem, the higher ability to problem solve the individual presents. This is true except in the case of an individual only asking guessing questions. The total questions asked can be further analyzed through identifying the total number of constraint questions and the total number of guess questions to determine the degree to which the child was able to ask questions that eliminated more than one picture.

Integration Planning Score

Integration Planning (IP) score is the number given to score the first question asked. This score is given based on a scale and is determined by the number of pictures the first question targets. This score indicates how well the child was able to integrate the pictures on the board before asking his/her first questions. A higher IP score equals a higher ability to integrate pictures. There are two different scales used to determine the IP score, depending on which board is being used. Both scales were created so that the highest score of 6 reflects an individual's ability to ask a question that eliminates half of the pictures on the board. The IP scales are specified on their corresponding recording forms and are as follows:

IP Scale for 12-item Boards

Number of Pictures Targeted with 1st Question	IP Score
1	1
2	2
3	3
4	4
5	5
6 or more	6

IP Scale for 24 and 32-item Boards

Number of Pictures Targeted with 1st Question	IP Score
1	1
2-3	2
4-5	3
6-7	4
8	5
9 or more	6

Question Asking Efficiency Score

The Question Asking Efficiency (QAE) score is the primary tool used to score the RAPS-K. This score is generated by finding the mean of the first four question efficiencies. A question efficiency (QE) quantitatively describes the effectiveness of a question and is determined using the following equation:

$$\left(\frac{\text{\# of pictures targeted or \# of pictures eliminated (whichever is smaller)}}{\text{\# of pictures considered}}\right) \times 2 = \text{QE}$$

Example from sample Recording Form 32.1

Question 1: Can you play with it?
Pictures considered: 32
Pictures targeted: 10
Pictures eliminated: 10
(10/32) x 2 = 0.63
QE #1 = 0.63

The result should be a decimal between .17 and 1.0 for 12-item boards, .08 and 1.0 for 24-item boards, and .06 and 1.0 for 32-item boards. Question efficiencies should be written as a decimal and rounded up to the nearest hundredth (two decimals). Note that it is possible for a question efficiency to be greater than 1.0 if the question eliminates over half of the remaining pictures. This is uncommon, which is why the maximum QE is listed as 1.0.

Next, average the first four question efficiencies by adding them together and dividing the sum by four. The equation is as follows:

(QE #1 + QE #2 + QE #3 + QE #4) / 4 = QAE score

Example from sample Recording Form 32.1

QE #1: 0.63 QE #2: 0.72 QE #3: 0.57 QE #4: 1.20

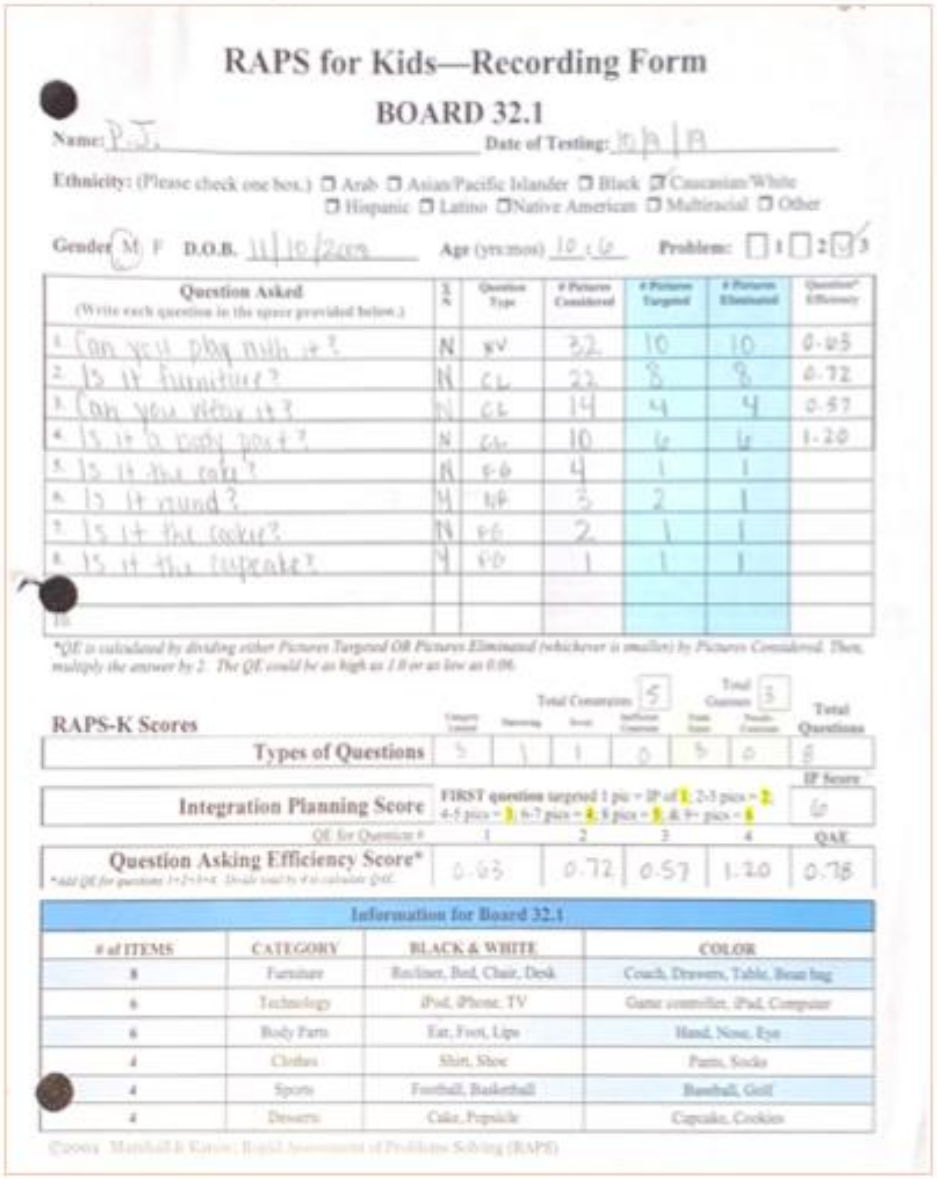
(0.63 + 0.72 + 0.57 + 1.2) / 4 = 0.78
QAE score = 0.78

These equations can be used with all three board types to generate the QEs and the QAE score. The QAE score is the best score to use if only considering a single measure when evaluating a child's performance on the RAPS-K. A higher QAE score represents a greater ability to ask questions that integrate pictures, effectively narrow the board, and solve the problem in a way that reflects a higher level of problem solving ability.

	QE for Question #	1	2	3	4	QAE
Question Asking Efficiency Score*		0.63	0.72	0.57	1.20	0.78

*Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.

Example of completed Recording Form 32.1



RAPS for Kids—Recording Form

BOARD 32.1

Name: P.T. Date of Testing: 10/9/18

Ethnicity: (Please check one box.) ☐ Arab ☐ Asian/Pacific Islander ☐ Black ☑ Caucasian/White ☐ Hispanic ☐ Latino ☐ Native American ☐ Multiracial ☐ Other

Gender (M) F D.O.B. 11/10/2009 Age (yrs:mos) 10:6 Problem: ☐ 1 ☐ 2 ☑ 3

Question Asked (Write each question in the space provided below.)	Y/N	Question Type	# Pictures Considered	# Pictures Targeted	# Pictures Eliminated	Question* Efficiency
1. Can you play with it?	N	EV	22	10	10	0.05
2. Is it furniture?	N	CL	22	8	8	0.72
3. Can you wear it?	N	CL	14	4	4	0.57
4. Is it a candy bar?	N	CA	10	6	6	1.20
5. Is it the cake?	N	FD	4	1	1	
6. Is it round?	N	AP	3	2	1	
7. Is it the cookie?	N	FD	2	1	1	
8. Is it the cupcake?	N	FD	1	1	1	
9.						
10.						

*QE is calculated by dividing either Pictures Targeted OR Pictures Eliminated (whichever is smaller) by Pictures Considered. Then, multiply the answer by 2. The QE could be as high as 1.0 or as low as 0.06.

RAPS-K Scores	Category Labeled	Narrowing	Asked	Inefficient Questions	Total Questions	Pseudo-Questions	Total Questions
Types of Questions	5	1	1	0	5	0	8

Total Questions: 5 Total Games: 3

		IP Score
Integration Planning Score	FIRST question targeted 1 pic = IP of 1; 2-3 pics = 2; 4-5 pics = 3; 6-7 pics = 4; 8 pics = 5; & 9+ pics = 6	6

	QE for Question # 1	2	3	4	QAE
Question Asking Efficiency Score* *Add QE for questions 1+2+3+4. Divide total by 4 to calculate QAE.	0.05	0.72	0.57	1.20	0.78

Information for Board 32.1			
# of ITEMS	CATEGORY	BLACK & WHITE	COLOR
8	Furniture	Recliner, Bed, Chair, Desk	Couch, Drawers, Table, Bean bag
6	Technology	iPod, iPhone, TV	Game controller, iPad, Computer
6	Body Parts	Ear, Foot, Lips	Hand, Nose, Eye
4	Clothes	Shirt, Shoe	Pants, Socks
4	Sports	Football, Basketball	Baseball, Golf
4	Desserts	Cake, Popsicle	Cupcake, Cookies

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Disclaimer

It is important to note that there has not been sufficient data collected to determine a 'passing' score. This assessment has been piloted with a group of 53 neurotypical children between the ages of 4:7 and 11:0, but normative scores were not determined due to limitations such as a small sample size. ***This assessment is not meant to result in a 'failing' score, but rather, to give insight into how well an individual is able to integrate information in order to solve a problem.*** Information is assessed in both a qualitative way through question types, and a quantitative way through total number of questions asked, IP score, and QAE score.

References

Marshall, R. C., & Karow, C. M. (2008). Update on a clinical measure for the assessment of problem solving. *American Journal of Speech-Language Pathology, 17*, 377-388.