feiferassessmentofreading™

feiferassessmentofmathematics™

Using Skills, Error, and Behavior Analyses with the Feifer Assessment of Reading (FAR) and the Feifer Assessment of Math (FAM):

Hidden Gems that Bring Detailed Strengths and Weaknesses to Light

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Executive Summary

Academic assessments are regularly administered to students to help educators learn about students' particular strengths and weaknesses in school subjects (e.g., reading and math). Unlike other academic assessments that only indicate if the student is above, at, or below grade level, the Feifer Assessment of Reading (FAR) and the Feifer Assessment of Math (FAM) are comprehensive measures that reveal a student's skills and problem areas. Both tests use a neuropsychological approach to connect specific strengths and weaknesses with underlying cognitive processes. Further, FAR and FAM scores indicate what, if any, specific learning difficulties the student may have (e.g., surface dyslexia, semantic dyscalculia)—a feature that sets these two tests apart from similar measures. Beyond this, the FAR and the FAM have built-in skills, error, and behavior analyses that assist when developing tailored interventions and individual education plans.

What are Skills, Error, and Behavior Analyses?

Skills, error, and behavior analyses allow examiners to dig deeper into a student's assessment performance to identify and understand specific strengths and weaknesses. Separate from a test's interpretable scores, skills, error, and behavior scores provide more detailed information that can be extremely useful for intervention planning and decision making, especially when considering the student's age or grade (Feifer & Gerhardstein-Nader, 2015; Greenberg, Ehri, & Perin, 2002; Kilpatrick, 2012).

Skills analyses provide optional supplemental scores that offer detailed information about a student's specific skills and strengths. A popular type of skills analysis involves calculating the number and percent of correct items in a given category of a particular subtest. For instance, on a reading test, examiners can obtain the percentage of correct target syllable types (e.g., digraph or short vowel) on a subtest designed to measure the ability to position sounds. On a math subtest developed to measure number comparison skills, they can determine the percentage of correctly answered decimals versus correctly answered fractions.

Error analyses have been well supported in the research literature and are strongly recommended strategies (Greenberg, Ehri, & Perin, 2002; Leu, 1982) for test interpretation. These types of evaluations shine light on specific weaknesses and can identify, for example, students who use verbal counting techniques for subtraction equations or those who repeat themselves in a word recall task more frequently than their same-grade peers.

Behavior analyses examine problem-solving strategies and decision making. They can provide helpful information for intervention planning, such as where a student hesitates or where he or she may overrely on behavioral cues such as counting verbally or on his or her fingers.

The information derived from skills, error, and behavior analyses is different from standardized scores attained through normal scoring procedures. As supplemental observations, these scores are not required for overall assessment interpretation. Although not standardized, these scores often can be compared with other values (e.g., standardization sample base rates) or across similar subtests. Assessment tools that integrate skills, error, and behavior analyses are more informative and comprehensive than similar measures that do not provide an opportunity for deeper analysis. The purpose of this white paper is to provide an overview of the skills and error analyses available with the Feifer Assessment of Reading (FAR; Feifer & Gerhardstein-Nader, 2015) and the skills, error, and behavior analyses available with the Feifer Assessment of Mathematics (FAM; Feifer & Clark, 2016) and explain how clinicians and school psychologists can assist their students more effectively by taking advantage of these hidden gems.

Skills analyses provide optional supplemental scores that offer detailed information about a student's specific skills and strengths.

Why Should I Use Skills, Error, and Behavior Analyses?

When used together, skills, error, and behavior analyses provide an in-depth view of a student's specific strengths and weaknesses. This information can inform intervention planning and allow school psychologists, clinicians, and tutors to tailor their support to a student's specific needs rather than using a one-size-fits-all approach.

The Phonemic Awareness (PA) subtest in the FAR provides a great example of the advantage of using skills and error analyses. This subtest investigates how students "understand distinct sound boundaries and link each isolated sound with a specific symbol or grapheme when reading and spelling" (Feifer & Gerhardstein-Nader, 2015). The PA standard score indicates how well a student performs on phonemic-related tasks in relation to his or her peers. If the student is not proficient in this area, skills and error analyses information can assist school psychologists and teachers as they develop individual education programs (IEPs) that incorporate phonemic awareness lessons.

Prior to administering the FAR, a school psychologist might at best be able to say:

> **"Ron is falling behind in reading compared to his classmates. We need to put him in a comprehensive reading program."**

However, if this student takes the FAR and scores low on the PA subtest, the school psychologist can now say:

> **"Ron is falling behind in reading compared to his classmates. His reading comprehension and fluency are great, but he struggles with phonemic awareness. We need to put him in a reading program that focuses heavily on phonemic awareness."**

FAR skills analyses allow the school psychologist to narrow the focus even further:

> **"Based on his performance on the FAR, it appears that Ron understands rhyming, but he would benefit from practice with blending, segmenting, and manipulation."**

Skills analyses can home in on specific issues so a student can get the focused practice he or she needs to succeed.

In this way, skills analyses can home in on specific issues so a student can get the focused practice he or she needs to succeed.

Skills and error analyses are built seamlessly into the FAR and skills, error, and behavior analyses are built into the FAM, making it easy for examiners to dig deeper and learn more about their students' specific strengths and weaknesses in reading and math. Gathering this supplemental information requires the examiner to notate key behavioral observations during testing and anticipate spending a few more minutes scoring. It's that easy. There is no need for additional testing—and there is no additional cost because the information is already included on the FAR and FAM Examiner Record Forms and in the professional manuals. After examiners familiarize themselves with the skills, error, and behavior analyses available for the FAR and FAM subtests, they can look for and notate specific behavioral observations during a testing session. Often, this can be as simple as checking a box at the end of a subtest if, say, the examinee erased or self-corrected.

In short, it takes just a few extra minutes of an examiner's time to obtain a wealth of valuable information. Why should you use a skills analysis? The better question is why *wouldn't* you?

FAR

FAR Skills and Error Analyses

The FAR is a comprehensive test designed to assess reading difficulties in students from prekindergarten through college. It uses a neurodevelopmental approach to "determine not only the presence of a reading disorder but also the specific dyslexia subtype" (Feifer & Gerhardstein-Nader, 2015). Information from the four FAR indexes (i.e., Phonological Index, Fluency Index, Comprehension Index, Mixed Index), helps school psychologists work with teachers and tutors to provide reading interventions tailored to each student's needs. However, skills analyses on FAR subtests allow for deeper insight into specific aspects of reading—such as consistent difficulty with medial vowel positions in words or recall intrusions in a list recall paradigm—that can be useful when developing accommodation and intervention recommendations.

To learn more about the development, administration, scoring procedures, and interpretation of the FAR, refer to the FAR Professional Manual (Feifer & Gerhardstein-Nader, 2015). Appendix I includes all skills and error analyses. Information about how to complete these analyses is found in Chapter 2, and interpretation is in Chapter 3. The following sections explain how valuable information can be unveiled when using the optional analyses available for each FAR subtest. This is followed by a case illustration, which demonstrates how skills and error analyses can be used to help inform intervention planning. See Appendix A of this white paper for a list of FAR subtests that offer skills and error analyses.

FAR Subtests

Phonemic Awareness (PA)

The PA subtest features a series of four tasks that measure students' phonemic awareness and processing skills. In the Rhyming task, students are asked to determine whether a series of word pairs sounds the same or if they sound different (e.g., "do the words ***dream*** and ***seem*** rhyme?"). The Blending task indicates a student's ability to identify words after hearing the examiner say the words at one syllable per second (e.g., can the student indicate that ***i-ma-gi-na-ble*** blends together to form the word ***imaginable***?). The Segmenting task is the inverse of Blending, in that it requires the student to break the syllables of individual words apart (e.g., if the examiner says, ***electrical***, is the student able to segment the word into ***e-lec-tri-cal***?). The Manipulation task is a phonemic modification task that asks the student to repeat a spoken word while adding, deleting, or substituting a specified sound within it (e.g., "Say 'bear' without the /b/ sound").

The true value of the PA subtest rests in evaluating the individual tasks that comprise it. For instance, phoneme rhyming difficulties might indicate a hearing acuity issue, or perhaps an aspect of the curriculum that has been overlooked. Either way, it suggests the student cannot decipher the 44 individual phonemes that make up the English language, which may be a red flag for dyslexia. Skills analysis on this subtest allows the examiner to calculate the percent of correct items in each task, which can be informative if any of those skills are significantly discrepant from the others—something that may be overlooked if the PA standard score (derived from the sum of all four tasks' raw scores) is the only value taken into account.

Rapid Automatic Naming (RAN)

The RAN subtest includes a series of timed tasks that require the student to read objects or individual letters aloud rapidly from a grid in the stimulus book. Attention, retrieval skills, and information processing all play a significant role in these rapid naming tasks because students must quickly and accurately recognize and name the stimuli.

The RAN skills analysis is partitioned out by age group (i.e., PK-Grade 2, Grades 3-5, Grades 6-8, Grades 9-10, and Grade 11 to college), which allows for more precise and developmentally appropriate comparisons. Examining the number of correctly and incorrectly named stimuli allows examiners to determine whether the student performed within an Acceptable, Elevated, or Highly Elevated range compared to his or her similar-grade peers. According to Frijters et al. (2011), poor performance on rapid naming tasks tends to result from difficulty recognizing text orthography in an integrative fashion. Furthermore, there may be attention issues also impacting performance.

Semantic Concepts (SC)

Composed of the Synonyms and Antonyms tasks, the multiple-choice SC subtest asks students to choose which of five words presented in the stimulus book is like or unlike the target word. For instance, of the words "somber, inarticulate, ecstatic, amenable, callous," the examinee is asked which is similar in meaning to the word "elated." Further skills analysis allows examiners to compare the percent of correctly named synonyms and antonyms. See Figure 1.

This subtest is a measure of vocabulary development that is informative both on its own and when compared to the Morphological Processing subtest (discussed later). Research has shown that poor reading comprehension skills often stem from deficits in core vocabulary development and semantic processing (Catts & Weismer, 2006; Nation, Clarke, Marshall, & Durand, 2004; Nation & Snowling, 1998). Because phonological development is emphasized so

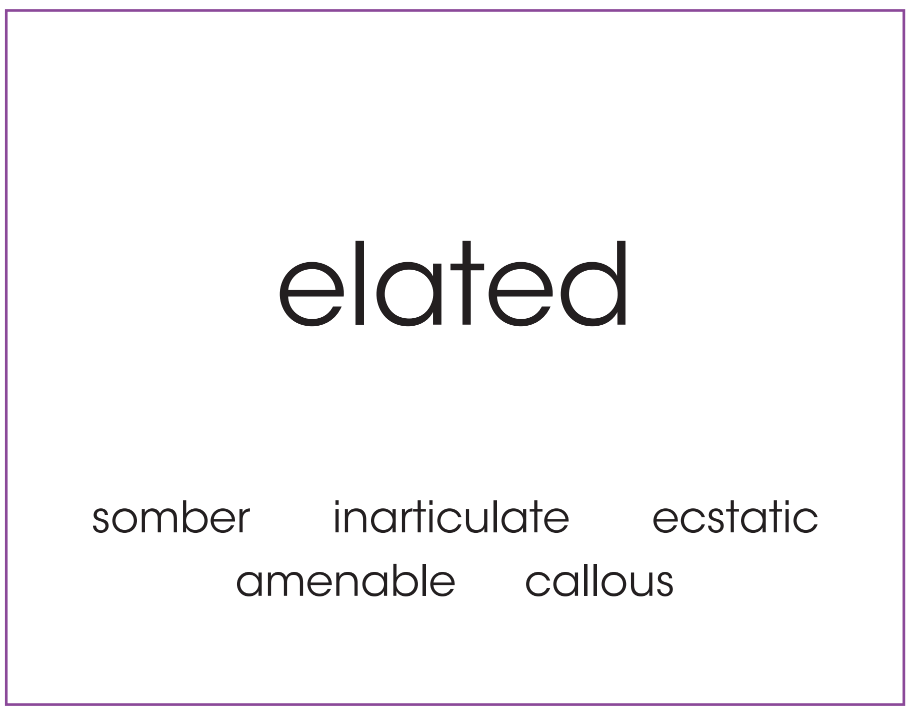

Figure 1. FAR Semantic Concepts subtest example.

strongly in the early years of reading development, vocabulary-related shortcomings can be overlooked, making the SC skills analysis a valuable source of information.

Word Recall (WR)

The WR subtest consists of two trials. In the first, the student is asked to recall as many words as possible from a list of words read aloud. In the second, the word list is read aloud again, but this time the examiner prompts the student to recall words that fall into certain categories (e.g., "Tell me all the words you remember that are parts of the body," and "Now tell me all the words you remember that are fruits").

Good performance on word recall tasks can be attributed to strong executive functioning skills because these students are proficient in categorizing information semantically. Skills and error analyses allow examiners to evaluate the number of correct responses, the number of repetitions, and the number of intrusions and compare them to other students' performance in the same grade grouping. Poor performance on the WR subtest can indicate poor executive functioning skills—in this case, remembering information solely by sequential order rather than by categorizing the words or giving meaning to them as stronger readers might. Without utilizing the skills analysis, examiners may think a memory issue is present, when in reality it could be a more strategic issue due to poor executive functioning skills.

Verbal Fluency (VF)

The VF subtest features a pair of tasks that requests students to name as many items of a certain category as possible within 60 seconds (e.g., "Tell me all the different animals you can think of without repeating any," and "Now tell me all the words you can think of that begin with the letter 'A'"). Responses are recorded in 15-second intervals, which helps to measure how quickly information can be retrieved from long-term memory.

During skills and error analyses of this subtest, examiners can compare the number of correct and incorrect responses with similar-grade students from the normative sample. This comparison yields the qualitative range in which the student falls (i.e., Acceptable, Elevated, or Highly Elevated). Because the VF subtest measures how quickly information can be recalled from long-term memory, poor performance on this subtest can indicate if a student uses phonological or orthographical cues inefficiently. Typically, students with learning disabilities perform significantly better when retrieving information from the lexicon using a semantic cue rather than a letter cue.

Nonsense Word Decoding (NWD)

To determine students' decoding skills, nonsense words (e.g., "ilkpranatapher") are presented independently in the stimulus book. The student is asked to pronounce each word aloud. Nonsense words are completely fabricated, so visual or orthographic strategies and semantic or morphological cues, which help to assist in word identification, have little value in decoding words that, by their very nature, are meaningless. See Figure 2.

For tasks such as the NWD subtest, students rely on decoding skills, which involve bottom-up interpretation and heavier reliance on working memory circuits while the brain stitches together each component of the word (Juphard et al., 2011; Feifer & Gerhardstein-Nader, 2015). The skills analysis allows for the comparison of the greatest number of syllables pronounced in the NWD task with the greatest number of syllables blended and the greatest number of taps from the PA Blending and Segmenting tasks. These are important factors when planning interventions because they measure the student's phonological working memory.

ilkpranatapher	refelkinin	con
belific	grinterio	featik
pernadiko	ublosory	trandle

Figure 2. **FAR Nonsense Word Decoding subtest example.**

Isolated Word Reading Fluency (ISO)

The ISO subtest is made up of phonologically consistent words that increase in difficulty. Beginning at a grade-appropriate start point, the student is asked to read as many words as he or she can in 60 seconds.

Examiners can divide the number of words read correctly in 60 seconds by the total time taken to obtain the ISO rate. The higher this rate, the better the student's performance. By directly comparing the ISO rate with the Oral Reading Fluency rate (detailed in the following paragraph), examiners can identify if the student has difficulties reading passages versus reading words in isolation. Stronger scores on the Oral Reading Fluency subtest than the Isolated Reading Fluency subtest often suggest that context clues are needed to assist with decoding and word recognition skills.

Oral Reading Fluency (ORF)

The ORF subtest consists of grade-appropriate stories, which the student must read aloud. There is a time limit of 60 seconds for each story, so quicker readers naturally receive higher scores. Like with the ISO subtest, examiners can divide the total number of words read correctly by the total time taken to obtain the ORF rate.

The ISO subtest can be used as a baseline for the ORF subtest because the stories contain the same target words. In addition to comparing the ORF and ISO rates, a word-by-word skills analysis of the target words allows the examiner to compare the percentage of correct target words between subtests. Significantly stronger ISO scores than ORF scores indicate that reading the words in context may interfere with pronunciation. Stronger ORF scores, on the other hand, suggest that the student relies more on semantic cueing to recognize words.

Visual Perception (VP)

For the VP subtest, younger students are given a response form that contains a grid of letters, and older students are given a grid of words. Some of these words have a letter that is reversed, and the student must mark as many of these words as possible within 30 seconds. Students in prekindergarten through second grade are given one page of these stimuli; grades three and higher must search across two pages. See Figure 3.

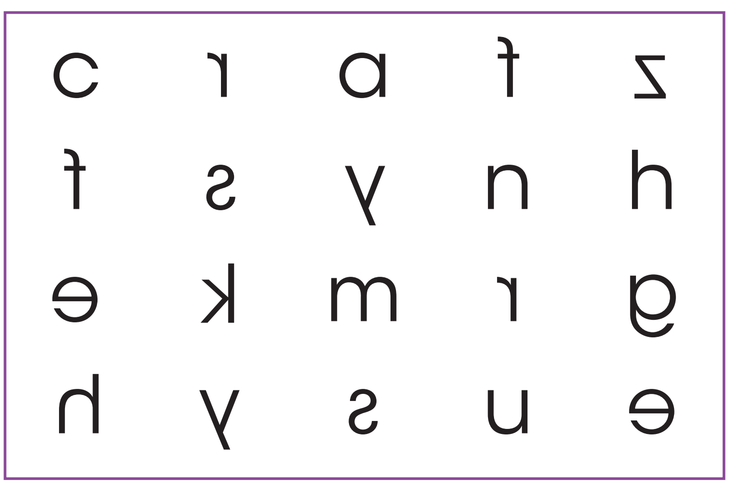

Figure 3. FAR Visual Perception subtest example.

Persistent letter recognition mistakes suggest that the brain may need more time to lateralize the reading and writing process. Students who frequently reverse letters might be unable to come up with an appropriate visual–spatial template of a letter or word (Brooks, Berninger, & Abbot, 2011). The VP skills and error analyses allow examiners to identify the number of correct targets and nontarget errors, which can be compared with same-grade peers and classified within a qualitative range (i.e., Acceptable, Elevated, or Highly Elevated). In addition, the examiner can determine which letters tend to be the most challenging.

Irregular Word Reading Fluency (IRR)

In the IRR subtest, students are asked to read as many phonologically irregular words (which are presented in order of increasing difficulty) as they can in 60 seconds (e.g., "could," "queued," "assuages"). Examiners can divide the number of correct words read in 60 seconds by the total time to obtain the IRR rate.

Examiners can compare IRR and ISO skills analyses directly because each subtest allows a fluency rate to be calculated. If the ISO score is much stronger than the IRR rate, the student most likely demonstrates good phonological assembly of familiar words and may rely on more of a bottom-up approach to recognize words in print. Alternatively, a stronger IRR rate suggests that the student uses a top-down approach to interpret words in print and may overrely on the visual contour, shape, and uniqueness of the alphabetic code when recognizing words in print (Feifer & Gerhardstein-Nader, 2015). Good readers tend to utilize a top-down and a bottom-up approach simultaneously to recognize words in print, so there should be little difference in performance on these two subtests for well-developed readers.

Orthographical Processing (OP)

In the OP subtest, students are shown a word in a stimulus book for one second. The examiner then flips the page and shows the student a series of four letters/letter combinations, from which the student must select the one that appeared in the word that was presented. For instance, the student must select which one of the following four letter combinations was present in the word ***exonerated***: xer, ner, ter, or mer. Nonsense or nonwords (e.g., “resgerivery”) are presented to well-performing students who do not meet the stop rule (i.e., four incorrect responses in a row).

A skills analysis for the OP subtest helps examiners ascertain the number of correctly identified words and nonwords. When divided by the total possible number of words and nonwords, the resulting percentages can provide insight about reading fluency and automaticity.

Positioning Sounds (PS)

For the PS subtest, the student is presented with a stimulus book that shows a word with a missing sound on each page (e.g., classr__m). The examiner says the target word (“classroom”) aloud, then asks the student to identify the sound that is missing (“oo”).

This subtest indicates how well a student interprets an auditory stimulus while using a visual cue, which is a precursor to developing the ability to decode words in print. The PS skills analysis is one of the most detailed FAR analysis because it breaks down the target syllable type (e.g., short vowel, diphthong) by item. The examiner can use this information to calculate the number and percentage of correct target syllable types easily. By determining if a student struggles with long vowels, short vowels, r-controlled vowels, digraphs, diphthongs, blends, or schwas, specific instruction can be tailored to these areas, and can also be translated into more meaningful IEP goals and objectives.

Morphological Processing (MP)

In the MP subtest, the examiner presents part of a word in the stimulus book, along with a blank line that indicates which part of the word is missing. Below this are five word fragments, one of which can fill in the blank to create a real word. For instance, “un__inable” is shown with the following options: bio, pop, firm, imag, and fract. See Figure 4.

MP skills analysis allows examiners to identify the number and percent of prefixes, roots, and suffixes the student answered correctly. Morphology skills represent a student’s understanding of the rules used to form new words, including changes that affect word meanings (Feifer & Gerhardstein-Nader, 2015), so utilizing this skills analysis can be particularly informative for designing interventions.

Silent Reading Fluency (SRF)

For the SRF subtest, the examiner presents students with two short, grade-appropriate stories (presented one at a time) in the stimulus book. The student is asked to read silently for a maximum allotted time of five minutes. At 60 seconds, the examiner asks the student to indicate which word he or she is on; this allows the examiner to calculate the student’s Silent Reading Fluency Rate (SRF-R). After reading the story, the examiner flips the page to reveal eight questions, which the student must answer without referring back to the story. The student’s responses from both stories are scored and summed to obtain the Silent Reading Fluency Comprehension (SRF-C) score.

Silent Reading Fluency: Comprehension (SRF-C). Students who have difficulty answering SRF-C questions may struggle due to poor working memory skills, or they may have executive dysfunction that affects their ability to plan and organize targeted information to facilitate later retrieval. The SRF-C skills analysis allows examiners to identify and

un___inable

bio pop firm imag fract

Figure 4. FAR Morphological Processing subtest example.

calculate the number and percentage of correct literal types of questions versus inferential questions. For instance, students with autism tend to struggle with more inferential questions, whereas students with ADHD tend to miss details or more literal types of questions.

Silent Reading Fluency: Rate (SRF-R). The SRF-R is calculated like the ORF rate, and these can be directly compared. These reading rate scores are frequently similar, but students who exhibit a quicker reading rate when reading silently may be using more top-down strategies to scan and recognize words in print automatically (Feifer & Gerhardstein-Nader, 2015). On the other hand, students with stronger ORF scores tend to use more bottom-up strategies as evidenced by a need to subvocalize words, using the brain's inner articulation system. If SRF subtest scores are much quicker than ORF subtest scores, the student may just be skimming the passage and not really reading for content.

FAR Case Illustration

Sam is an eighth grader who has had trouble keeping up with his peers' reading performance. He has studied with three tutors since fifth grade but cannot manage to reach expected grade-level performance. On his teacher's recommendation, the school psychologist administered the FAR to determine where Sam's reading problems originate and to decide how best to intervene.

Sam's average performance on some FAR subtests indicated many strengths, such as good visual working memory skills, strong spelling, good overall language development, and a wide breadth of vocabulary knowledge. However, FAR skills and error analyses brought additional issues to light, such as his struggles with decoding text orthography. This was highlighted by his poor performance on blend/clusters versus other target syllable types on the PS subtest and by a high number of errors on the VP subtest relative to his same-grade peers in the FAR standardization sample. Using the item-by-item skills analysis to compare Sam's ISO performance against his ORF score revealed that he struggled with the visual scanning and tracking demands of reading words in a horizontal fashion. He read many more words aloud correctly when they were presented individually than when contained within the context of a story. When thoughtfully asked about this, Sam revealed that he had performance anxiety when asked to read longer passages aloud.

Sam's reading performance improved greatly after implementing targeted interventions recommended by the school psychologist. His tutor used a balanced reading program that emphasized rapid word recognition and text orthography skills and focused on developing fluency and comprehension skills. Together, they employed a combination of individual word reading skills and contextual-based reading strategies, such as color coding with markers, using word decks, creating story maps, and summarizing a story or passage immediately after reading. Sam and his tutor practiced reading short paragraphs aloud before moving on to short stories. His tutor created a visual graph that showed weekly improvement of the average number of words read correctly in a minute; Sam indicated that seeing this progress helped boost his confidence and encouraged him to read more on his own. Within a few months, his grades had significantly improved. He reported that he began to enjoy reading and read more books in his free time.

FAM

FAM Skills, Error, and Behavior Analyses

The FAM is an instrument that identifies mathematical learning difficulties and delays in students from prekindergarten through college. The FAM's three indexes separate performance information into three main math domains—procedural, verbal, and semantic—which allows school psychologists to work with teachers and tutors to provide targeted math interventions. Skills, error, and behavior analyses, however, provide insight about the student's mathematical *habits*, which can shed light on problem-solving skills, efficiency, and ability to adapt to unique challenges. For instance, some students "may overrely on their fingers to count due to working memory limitations; perhaps other examinees always count out loud because they need an auditory anchor to hold their place when sequentially ordering digits" (Feifer & Clark, 2016). Using scores from FAM subtests and indexes along with the supplemental information provided by skills, error, and behavior analyses allows school psychologists to develop personalized, more effective mathematical interventions.

The FAM manual (Feifer & Clark, 2016) contains developmental and interpretive information about the FAM as well as administrative and scoring procedures. Refer to Appendix I for all skills, error, and behavior analyses charts. Information about completing FAM skills and error analyses is available in Chapter 2, and interpretation is in Chapter 3. The following details analyses available for each FAM subtest, including what kind of information can be gleaned from the student's performance, and offers a case illustration. See Appendix B of this white paper for a list of FAM subtests that offer skills, error, and behavior analyses.

Skills, error, and behavior analyses provide insight about the student's mathematical habits, which can shed light on problem-solving skills, efficiency, and ability to adapt to unique challenges.

FAM Subtests

Forward Number Count (FNC) & Backward Number Count (BNC)

The FNC subtest first asks students what number follows a certain number (e.g., "What number comes after 9?"), then asks students to count forward by specific increments (e.g., "Starting at 48, count forward by threes"). Similarly, the BNC subtest asks students what number precedes a certain number (e.g., "What number comes before 2?"), then asks students to count backward at specific increments (e.g., "Starting at 41, count backward by fives").

Many students who struggle with the procedural system begin at one each time they count to avoid losing their place. Students who are challenged by skip counting use the ones strategy to help remember their place when working forward or backward on a number line. FNC and BNC skills and behavior analyses allow examiners to calculate the percentage of correct responses, to record the number of times the examinee dropped back and counted forward and used the ones strategy (i.e., counting sequentially by ones without skip counting), and to assign a qualitative descriptor (i.e., Acceptable, Elevated, or Highly Elevated) to these scores. Comparisons of the student's performance on the FNC and BNC subtests can also provide insight about the types of problems the student experiences. See Figure 5.

Numeric Capacity (NCA)

The NCA subtest asks students to remember and immediately repeat a set of single-digit numbers orated by the examiner (e.g. "7, 3, 9, 1"). Digit spans range from two to nine numbers. Determining the length of the longest digit span recalled provides insight about the student's symbolic working memory capacity for digits, which can be correlated with procedural operations and mental math skills.

Skills analysis for the NCA subtest allows the length of the student's longest digit span recalled to be compared to the percent of the standardization sample by grade group. For instance, if the longest digit span a fourth grader recalled was three digits, an examiner can determine that 1% of third through fifth graders in the normative sample also recalled three digits. This type of comparison can help users determine how well the student performed in relation to peers in the same grade group. In addition, limitations with numeric capacity suggest the amount of "mental math" a student can handle before needing paper and pencil assistance.

Rapid Number Naming (RNN)

In the RNN subtest, students name numbers as quickly as they can from a grid in the stimulus book. The RNN subtest indicates the student's number identification skills, and error and behavior analyses assign qualitative descriptors (i.e., Acceptable, Elevated, or Highly Elevated) to the number of errors. Additionally, the base rate for skipping lines in the standardization sample is presented by grade group.

Fluency

The FAM includes four Fluency subtests—Addition Fluency (AF), Subtraction Fluency (SF), Multiplication Fluency (MF), and Division Fluency (DF). For each subtest, the student has 30 seconds to write the

Table I.1
Skills and Behavior Analysis for Forward Number Count (FNC)

				Dropping back and counting forward total qualitative range				"Ones" strategy total qualitative range		
Grade	Number correct	% correct	Dropping back and counting forward total	Acceptable	Elevated	Highly elevated	"Ones" strategy total	Acceptable	Elevated	Highly elevated
PK to Grade 2	/30		/12	0-1	2-4	5+	/18	0-6	7-13	14+
Grade 3 to Grade 5	/30		/12	0	1-3	4+	/18	0-5	6-12	13+
Grade 6 to Grade 8	12/30	40%	5 /12	0	1-3	4+	7 /18	0-4	5-11	12+
Grade 9 to Grade 10	/30		/12	0	—	1+	/18	0-4	5-11	12+
Grade 11 to college	/30		/12	0	—	1+	/18	0-4	5-11	12+

Figure 5. FAM Skills and Behavior Analyses for the Forward Number Count subtest.

answers to a set of single-digit addition, subtraction, multiplication, and division problems (e.g., "8 – 2 = __"). The skills, error, and behavior analyses encourage examiners to calculate the percent of correct responses, number of errors, number of times the student counted on his or her fingers, number of times the student counted aloud, and the rate. Qualitative descriptors (i.e., Acceptable, Elevated, or Highly Elevated) can also be assigned to the number of errors, finger counting total, and verbal counting total.

As discussed in the FAM manual, "examinees who add on their fingers may have difficulty with automatic retrieval skills of overlearned facts, or perhaps these basic math facts were never initially learned" (Feifer & Clark, 2016, p. 64). Counting aloud to solve basic math equations suggests that the student requires auditory cues to maintain his or her place in number sequences; this is frequently an indicator of symbolic working memory skills.

Perceptual Estimation (PE)

The PE subtest first asks students to identify which of two images in the stimulus book contains more of a specific object (e.g., "which box contains more cookies?"). Students are then shown two images—one with a number underneath it and one without a number underneath it. See Figure 6. They must use the first image and number to estimate the number of items shown in the second image. For instance, if the first image had 30 cartons of milk and the second image has about half that, the student might estimate that there are 15 cartons of milk in the second image.

Students are specifically instructed to *estimate*—not count—the items, so if a student attempts to count, he or she may have poor magnitude representation skills, which can be traced to a poor approximate number system within the inferior regions of the parietal lobes of the brain. The behavior analysis provides the base rate of individuals in the standardization sample in certain grade groups who attempted to count.

Object Counting (OC)

In the OC subtest, students in prekindergarten through second grade are asked to count objects in various images and match numerals to their corresponding amounts (e.g., match the fraction $3/8$ of a pizza with an image of 3 of 8 slices missing).

Behavior analysis provides qualitative descriptors (i.e., Acceptable, Elevated, Highly Elevated) to classify the number of times the student counted on his or her fingers or skip counted. Skip counting is a method often used by students who have a stronger understanding of number sense. In contrast, those who often use their fingers to count tend to rely on visual or physical cues to keep track of their place in the counting sequence.

Number Comparison (NCO)

For this subtest, students must identify which of two numbers presented in the Examinee Response Form is larger. Items begin with simple, single-digit comparisons such as 1 or 2, but increase in difficulty to items such as $4/9$ or $1/3$. Students must answer as many items as they can within the 60-second time limit.

The NCO subtest skills analysis identifies the percentage of correct items broken down by skill (i.e., numerals, fractions, decimals, fractions vs. decimals, and negative numbers), which can inform specific learning

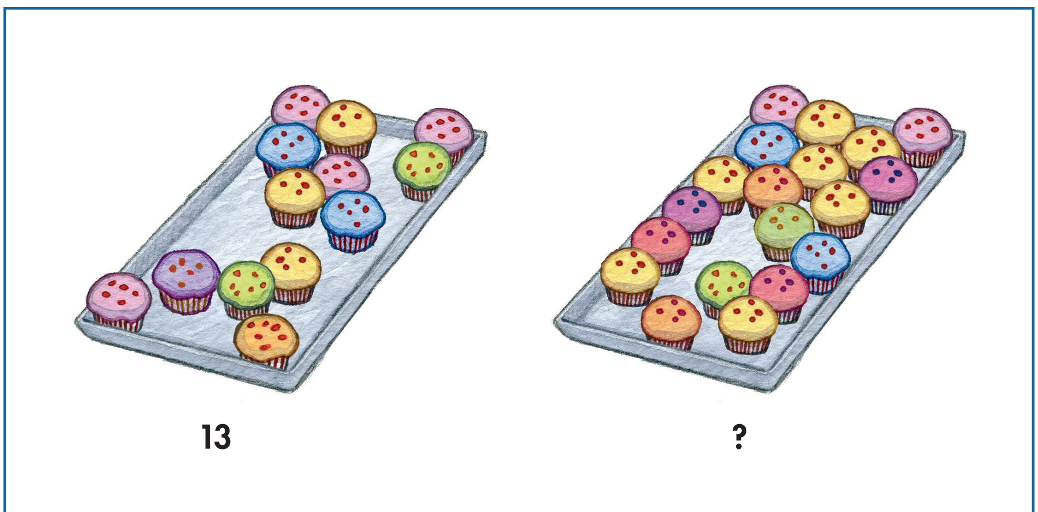

Figure 6. FAM Perceptual Estimation subtest example.

interventions. The error analysis allows the examiner to calculate the number correct and number of errors and provides qualitative descriptors (i.e., Acceptable, Elevated, Highly Elevated) by grade group in the standardization sample. See Figure 7.

Knowledge

The FAM includes four Knowledge subtests—Addition Knowledge (AK), Subtraction Knowledge (SK), Multiplication Knowledge (MK), and Division Knowledge (DK). For each subtest, the student has 60 seconds to write in the missing number from a set of addition, subtraction, multiplication, and division problems (e.g., "32 ÷ __ = 4").

Skills, error, and behavior analyses for the Knowledge subtests provide detailed information, including the number correct, percent correct, number of errors, and the rate. Qualitative descriptors (i.e., Acceptable, Elevated, or Highly Elevated) based on grade group can be assigned. The standardization sample's base rates of working out answers, finger counting, and verbal counting are provided and are broken down by grade group. Students who use the margins of the Examinee Response Form to work out answers or those who use their fingers to count may have difficulty with working memory and automatic retrieval skills; those who work through basic math facts verbally may have difficulties with symbolic working memory.

FAM Case Illustration

Rae is in fourth grade and has been struggling in her math class. Despite doing well in her one-on-one tutoring sessions, she has not made any notable improvement on her test grades, and her math teacher is concerned about how far Rae has fallen behind in class.

Rae's FAM scores indicated that she struggles with semantic understanding and arithmetic procedures. However, the skills, error, and behavior analyses drilled down and pinpointed Rae's difficulty with sustained attention and mental representation. She consistently used the ones strategy on the FNC and BNC subtests, which indicates that she has trouble remembering her place when mentally navigating a number line. This was further evidenced on the Fluency subtests, where she wrote in the columns and counted on her fingers frequently. These behaviors are indicative of poor symbolic working memory and poor procedural skills. Additionally, her poor performance on the NCA subtest and inconsistent pace on the RNN subtests demonstrated that she struggles with sustained attention. Rae made few mistakes when compared to other third-to-fifth graders within the normative sample and on timed subtests, although she tended to sacrifice speed for accuracy. This suggested that she has a propensity to answer only when she is confident in her answers.

Rae's consistent reliance on physical and visual cues was an indicator that she struggled with visualizing basic math concepts. Some of her interventions included implementing graphic representations, such as number lines and charts, which helped her see and better understand number manipulation and improve her mental conceptualization over time. With less reliance on scribbling each step of a math equation in the blank spaces of a test, she reported having more time to answer more test questions.

Some aspects uncovered by the skills analyses, such as Rae's notable hesitation to respond when uncertain in her answers, also revealed that Rae had notable math anxiety. Math anxiety can often hinder

1	4	6	5	15	26	106	80
119	125	6,766	6,677	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{5}$	.30
.235	.29	$\frac{7}{5}$	$\frac{4}{3}$	6.75	7.99	$\frac{1}{25}$	.019

Figure 7. FAM Number Comparison subtest example.

working memory, which can in turn negatively impact attention span and may also be a contributing factor to low self-confidence. There are many ways to address math anxiety, but interventions such as allowing more time on tests helped Rae focus more on the equations on the page than the time left on the clock. Working on timed and non-timed practice tests and receiving guidance about why an answer is incorrect and how to arrive at the correct answer also significantly reduced Rae's math anxiety. With less of her attention fixated on her slow performance compared to her classmates, Rae reported that she was able to focus on the equations in front of her fully and felt more confident in her responses.

Conclusion

Skills, error, and behavioral analyses on the FAR and the FAM allow examiners to see below the surface of a student's reading and math learning difficulties. While individual subtest and index scores may indicate if a child struggles in a particular area, the ability to drill down even deeper using simple steps already built into a test helps explain more clearly why a student struggles. This can inform specific academic accommodations and intervention strategies and lead to long-term and lifelong math and reading success.

Appendix A:

Types of Additional Analyses on the Feifer Assessment of Reading (FAR) by Subtest

		Analysis type		
Index	**Subtest**	Skills	Error	Behavior
PI	PA	x		
	NWD	x		
	ISO	x		
	ORF	x		
	PS	x		
FI	RAN	x	x	
	VF	x	x	
	VP	x	x	
	IRR	x		
	OP	x		
CI	SC	x		
	WR	x	x	
	PK			
	MP	x		
	SRF-C	x		
	SRF-R	x		

Note. PI = Phonological Index; FI = Fluency Index; CI = Comprehension Index; PA = Phonemic Awareness; NWD = Nonsense Word Decoding; ISO = Isolated Word Reading Fluency; ORF = Oral Reading Fluency; PS = Positioning Sounds; RAN = Rapid Automatic Naming; VF = Verbal Fluency; VP = Visual Perception; IRR = Irregular Word Reading Fluency; OP = Orthographical Processing; SC = Semantic Concepts; WR = Word Recall; PK = Print Knowledge; MP = Morphological Processing; SRF-C = Silent Reading Fluency: Comprehension; SRF-R = Silent Reading Fluency: Rate.

Appendix B:

Types of Additional Analyses on the Feifer Assessment of Mathematics (FAM) by Subtest

Index	Subtest	Analysis type		
		Skills	Error	Behavior
PI	FNC	x		x
	BNC	x		x
	NCA	x		
	SEQ			
	OC			x
VI	RNN		x	x
	AF	x	x	x
	SF	x	x	x
	MF	x	x	x
	DF	x	x	x
	LMC			
SI	SM			
	EB			
	PE			x
	NCO	x	x	
	AK	x	x	x
	SK	x	x	x
	MK	x	x	x
	DK	x	x	x

Note. PI = Procedural Index; VI = Verbal Index; SI = Semantic Index; FNC = Forward Number Count; BNC = Backward Number Count; NCA = Numeric Capacity; SEQ = Sequences; OC = Object Counting; RNN = Rapid Number Naming; AF = Addition Fluency; SF = Subtraction Fluency; MF = Multiplication Fluency; DF = Division Fluency; LMC = Linguistic Math Concepts; SM = Spatial Memory; EB = Equation Building; PE = Perceptual Estimation; NCO = Number Comparison; AK = Addition Knowledge; SK = Subtraction Knowledge; MK = Multiplication Knowledge; DK = Division Knowledge.

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