Chapter 3

Practical Considerations in WISC-V Interpretation and Intervention

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INTRODUCTION

Interpretation of the WISC-V scores is typically done in the context of making recommendations for educational interventions for children and adolescents. This chapter provides a guide for interpretation of the WISC-V as a measure of *g* or overall ability, as well as a set of measures of specific abilities. To aid practitioners with developing intervention strategies, the chapter continues by linking interventions to the specific cognitive abilities that WISC-V measures.

In this chapter, we first discuss common challenges to interpreting WISC-V scores for students where there is broad variance among the scores. Next, we present an analogy designed to promote a more intuitive understanding of the abilities measured by each index. Finally, we consider some fundamental suggestions for teachers and parents who have children with weaknesses in one of the primary cognitive abilities. These suggestions, guidelines, and heuristics are drawn from both research and clinical practice to provide further insights into the applications of the WISC-V as an important part of the clinical assessment process. Suggestions are not presented as a clinical "cookbook" of either diagnostic hypotheses or clinical interpretations of the abilities.

LEVELS OF INTERPRETATION: WHEN THE OVERALL ABILITY SCORE DOES NOT TELL THE WHOLE STORY

Tracey's WISC-V scores show that her abilities are not evenly developed. There were significant differences between 3 of the index scores that call into question

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the meaningfulness of the FSIQ. But our Director says that this score is needed in order to secure additional funding for special education support for this student.

Wally's teachers have commented on his variable performance across school subjects since entering school 3 years ago. While some earlier test results reporting a summary IQ score indicated that he may have the overall cognitive ability to cope with a regular program, the results of the current assessment suggest that the more relevant focus of his school learning and achievement difficulties may be found in the significant and rarely occurring score differences between his high average VCI, low average WMI and PSI, with borderline scores on the VSI and FRI.

Analysis of the discrepancies among the index score is routinely accepted as good clinical practice, especially when such interpretation occurs in the context of general ability (Flanagan & Kaufman, 2004; Kaufman, 2013; Sattler, 2008). Significant discrepancies among a student's index scores should be interpreted as indications of relative strengths or weaknesses in the cognitive constructs they measure. As most practitioners have observed, an identified strength or weakness in one of these major cognitive abilities will often manifest in classroom behavior. For example, teachers will likely find that a student who has a significant weakness on the Working Memory Index (WMI) tends to forget assignments; or one has who has a weakness on the Processing Speed Index (PSI) takes longer to process instructions than classmates. Such information is beneficial to educational planning.

However, profile analysis of WISC-V index scores is not by itself diagnostic of any particular psychoeducational or clinical disorder. The index scores represent major cognitive abilities. Therefore, a cognitive deficit in one of these areas may be associated with any of several disorders related to that ability. A significant weakness on WMI, for example, may be a common finding in groups with attention-deficit/hyperactivity disorder (ADHD) but also occurs with some frequency in groups with learning disabilities (LD) and traumatic brain injury (TBI). It is for this reason that index score patterns should be considered consistent with but not confirmatory of a diagnosis, and must be combined with other information to rule out alternative diagnostic hypotheses. The cognitive deficits related to such disorders will be discussed further in the final two chapters.

Two examples of a student with a deficit as measured by the WMI demonstrate this concept. For a student referred for possible ADHD, a low WMI, combined with high scores on a parent rating scale for ADHD behaviors, low scores on a continuous performance task of sustained attention, and a developmental and educational history of deficits in attention, impulsivity, or hyperactivity, the practitioner may feel confident in making a diagnosis of ADHD. The preponderance of supporting information along with the low WMI leads to this conclusion. However, for a student athlete who had an on-field concussion referred for reading comprehension problems, a low WMI score would instead warrant further evaluation to investigate a possible traumatic brain injury.

Investigation of Wechsler scores, at all levels, should be conducted within an ecological context (Prifitera, Saklofske, & Weiss, 2005, 2008; Weiss,

Saklofske, Prifitera, & Holdnack, 2006). Interpretation of score patterns may vary depending on the sociocultural background (Georgas, Weiss, van de Vijver, & Saklofske, 2003; Harris & Llorente, 2005), family values, pattern of academic strengths and weaknesses, motivation, and psychiatric and medical history. Interpretation also needs to consider behaviors observed during the test session (Oakland, Glutting, & Watkins, 2005; Sattler & Dumont, 2004). A common mistake is to offer stock interpretations of index score patterns while ignoring the effects of these mediating influences (see Kamphaus, 1998). Consider, for example, two children each having a Full Scale Intelligence Quotient (FSIQ) score of 112, which, by itself, suggests high average ability. The child with a superior Verbal Comprehension Index (VCI) and low average WMI, will certainly present differently in the classroom than a typically developing child with statistically consistent subtest and index scores yielding an FSIQ of 112. The first child may appear much brighter and much less attentive than the second children even though they have the same FSIQ score. Remember that children may perform contrary to expectations on testing. For all of these reasons, the interpretations of WISCV test scores will differ in relation to the examinee's personal context and history. In addition, the examiner's expectations of the likelihood of finding certain patterns will be influenced by the referral questions and hypotheses.

How Important is *g*, the Measure of Overall Ability?

Curiously, one camp of psychometric researchers argues that the modest portions of variance attributed to the first order factors (the index scores) may be too small to be of clinical importance, should not be used diagnostically, and that therefore FSIQ is the only score worth interpreting (Canivez & Kush, 2013; Canivez & Watkins, 2010). However, data analysis of these studies indicates that the researchers statistically removed *g* from the index scores and examined only their residual validity. This approach is problematic because an individual's investment of *g* resources in particular directions results in greater development of those abilities over time (Reynolds & Keith, 2013). Thus, removing the influence of *g* from the index scores effectively cripples their power, and creates a rather artificial situation. As Schneider (2013) observed:

> *…the independent portion is not the "real Gc". We care about a sprinter's ability to run quickly, not residual sprinting speed after accounting for general athleticism. So it is with Gc: g is a part of the mix. (p. 6)*

Another camp of neuropsychological researchers and clinicians argues that FSIQ is a meaningless composite of various disparate abilities and should not be interpreted at all (Hale, Fiorello, Kavanagh, Holdnack, & Aloe, 2007; Kaplan, 1988; Lezak, 1988; Lezak, Howieson, & Loring, 2004). This point demonstrates the incredible diversity of opinion that exists in the field. One camp argues that interpretation of index scores is invalid and recommends interpreting only FSIQ

while the other camp argues that interpretation of FSIQ is invalid and recommends interpreting only the index scores.

We do not agree with either camp. Both views have merit, but both views are too one-sided to be workable. We believe that *g* and the broad abilities are both important and that each construct has a place in the practice of assessment.

What is a practitioner to do? We suggest that it depends on the referral question. When the purpose of the evaluation is to efficiently predict a broad range of cognitively driven behaviors, then *g*—as defined by FSIQ—is always the best score to use. Further, we think that heterogeneous tasks, which require integration of multiple abilities for successful performance, will enhance the ecological validity of predicting a broader range of cognitively driven, real-world behaviors. On the other hand, examining particular broad and narrow abilities is necessary when evaluating clients for specific cognitive impairments, neurological conditions, and learning and attentional disorders. Thus, it is not one approach or the other. Strength and weakness interpretations vary in the context of the child's overall level of *g* as evidenced by differing frequencies of discrepant indexes by ability level (Wechsler, 2014).

There is evidence that having one or more low cognitive ability scores is commonly observed among healthy individuals; therefore, practitioners should be cautious when interpreting low scores as conclusive evidence of brain injury or disease in forensic evaluations (Brooks, Holdnack, & Iverson, 2011). The common finding of one or more low index scores in normal subjects, however, suggests that for individuals, *g* does not manifest itself equally across the broad cognitive abilities. Whether for reasons of environmental opportunity or personal and vocational interest, individuals appear to invest *g* resources selectively. They thereby develop some broad abilities at the expense of others over time (cf. Cattell, 1987; Kvist & Gustafsson, 2008; Reynolds & Keith, 2013). This is one reason why clinicians find it difficult to conceptualize the broad abilities independent of *g*—although it is possible to accomplish statistically. As Claeys (2013) observes: "No one is more aware that test factors don't always 'hang together' than those assessing children and adults on a daily basis." How true!

One issue remains. That is, should FSIQ be reported when there is significant variability among the index scores? In other words, is there a statistical or clinical point where FSIQ "fractures" into more meaningful parts, and is no longer a valid measure of general mental ability nor clinically useful for assisting with differential diagnosis or program planning?

The child's overall level of cognitive ability provides a critical backdrop to interpretation of individual differences among the various domains of ability as assessed by the index scores. The calculation of an FSIQ continues to be important for this and several other reasons. From a purely psychometric perspective, a general factor clearly emerges in all studies of intelligence (Carroll, 1993). This fact, combined with the integrity of the five factor structure and the magnitude of the correlations between the index scores make a psychometrically compelling case for the interpretation of the FSIQ.

Further, recent WISC-IV studies suggest that FSIQ may be an equally valid measure of general ability for individuals or groups having highly variable index scores as for those having consistent index scores (Daniel, 2007). WISC-III and WISC-IV studies further suggest that there may be no difference in the predictive validity of FSIQ for low-scatter and high-scatter groups (Watkins, Glutting, & Lei, 2007).

FSIQ is an especially strong predictor of school achievement, occupational success, and memory functioning. FSIQ and achievement correlate more strongly than any two variables known to the behavioral sciences, typically around 0.70. For example, Deary, Strand, Smith, and Fernandes (2007) reported that general mental ability measured at age 11 years is highly correlated ($r = 0.81$) with general educational achievement and further with different subject areas at age 16 years. This means that FSIQ explains about 65% of the variance in achievement. Additional relevant factors likely include the student's perseverance, drive to task mastery, self-regulation toward a goal, and other constructs related to emotional intelligence. Beyond the relationship with achievement, there is considerable ecological and criterion validity for the use of an overall estimate of general intelligence in a variety of areas related to success in life including college readiness, predicting job performance, creativity, and innovation (Gottfredson, 1997, 1998; Kuncel, Hezlett, & Ones, 2004; Squalli & Wilson, 2014).

The Importance of Interpreting the Component Abilities

Although FSIQ has strong psychometric integrity and predictive power, large discrepancies among the component abilities of FSIQ are often observed in clinical practice. We believe that it is these large discrepancies that may provide the most clinically interesting and useful information of relevance to the assessment protocol. In cases of intellectual giftedness or moderate to severe mental retardation, we can expect a relatively flat profile and a summary or FSIQ score can certainly be used to describe the cognitive component of this finding. As well, similar subtest and index scores of a child with FSIQ of 107 certainly allows the psychologist to describe this child as having average ability and further manifesting average Verbal Comprehension (VC), Visual–Spatial (VS), Fluid Reasoning (FR), Working Memory (WM), and Processing Speed (PS) abilities. This would then shift the hypotheses related to poor school performance to other cognitive factors, such as auditory phonemic awareness or long-term memory retrieval; or to noncognitive factors such as work and study skills, personality, motivation, learning style, and the teaching-learning-social environment of the classroom. However, in other cases such as recent lateralized brain trauma, the presence of a large discrepancy between, for example, VC and VS may be very meaningful and should be the focus for interpreting cognitive abilities.

Thus, it is prudent to take the position that the presence of large discrepancies among index scores, reflecting unevenly developed cognitive abilities,

makes interpretation of the child's overall intellectual functioning more difficult and complex. Such variability then points to the need to shift test interpretation to the index scores where the most clinically relevant information is more likely to be found. Having five cognitive factors to interpret a child's abilities is a strength of the WISC-V theoretical structure.

Similarly though, any factor-based score such as the PSI becomes more difficult to interpret when the subtest scores within the index are too variable. Significant score differences between the subtests on the same index are clear indicators that the composite does not provide a reliable indication of the child's ability in that domain. Rather than focusing on a less meaningful summary score, determine the clinical relevance of the subtest findings. Assumptions to cover are that the test was properly administered and scored, the testing conditions were adequate, and the examinee was both motivated and seemed to understand the task demands. An example for Processing Speed would show scaled scores of 13 for Symbol Search versus 4 for Coding. These scores might result from differences in the task and the greater requirement for fine motor coordination on Coding. Consider also noncognitive factors, such as interest and motivation or even scoring errors! While careful administration and scoring are essential to providing "valid" data, one should always have enough clinical commonsense to be able to say: "that score can't be right, because the child answered almost all of the items on the Similarities subtest."

Once the analysis of test scores is accomplished in this detailed, bottom-up manner, the interpretation may be made in the traditional top-down manner, whether it begins with the FSIQ or index scores. Top-down and bottom-up approaches can be used in an integrative way to explore various clinical interpretations. Thus, although the FSIQ can be a clinically meaningful summary of a child's overall cognitive functioning, an examination of the subtest scores and index scores can also provide meaning and insight to the assessment process. Targeting the examination to specific abilities can also be informed by information from referral sources. Kamphaus (2001) states that a hypothesized pattern of strengths and weaknesses based on such factors that are subsequently observed in the test data leads to a more meaningful interpretation than the same pattern identified by comparing all possible test scores. Looking for significant differences between all subtest scores is bound to lead to a statistically significant finding simply because of the number of comparisons being made. This possibility is further confounded comparing score differences based on the statistical analyses of a large standardization sample to the single case (nomethetic or generalized versus idiographic or more personalized comparisons).

There has clearly been a change in emphasis in the evolution of the Wechsler tests from primarily measuring IQ only to focusing on the five major cognitive abilities assessed by the VC, VS, FR, WM, and PS indexes. This change brings the WISC-V more in line with the psychologist's current need for a test that has implications for description, diagnosis, and prescription.

Although the standard procedure for investigating and reporting a child's WISC-V profile may begin at the Full Scale level and then proceed with an analysis of the index and subtest scores, invariably there are times when this is not the best practice to follow. In fact extreme discrepancies between scores are the more common finding.

In summary, a general intelligence factor is one of the most robust findings in the history of psychology. A century of evidence shows that it is substantially related to school achievement as well as a wide variety of real-world outcomes. Some psychometric researchers have suggested that *g* is so robust that it fully accounts for all of the broad cognitive abilities and argue that interpretation should be restricted to FSIQ alone. Nonetheless, *g* needs to be interpreted within the context of its component abilities. Since each of the WISC-V subtests is predicated on a broader interpretation of the ability being assessed, it is impossible to separate the overall ability from its components. One cannot remove working memory from fluid reasoning or verbal comprehension. A second order *g* factor also emerges in all other major intelligence tests including but not limited to the Stanford-Binet, Woodcock-Johnson-IV, Differential Abilities Scales-II, Kaufman Assessment Battery for Children-II, and the Das-Luria test battery.

Arguing the opposite, other researchers state that FSIQ should never be interpreted because it is simply a normative averaging of diverse cognitive functions with different neuropsychological underpinnings. Our view is that test results showing significant variance among the index scores or subtest scores are not psychometric or clinical problems at all. Rather, the variance in scores within the ability test provides clinical opportunities to gain insight into a child's unique pattern of strengths and weaknesses. When large discrepancies among index scores are present, we recommend reporting the FSIQ, but focusing interpretation solidly on the index scores. For example:

> *The pattern of Aalyah's scores suggests uneven development across various areas of cognitive ability, even though the combination of her abilities gives an Average FSIQ score of 97. In particular, her verbal conceptualization abilities (VCI 109) are much better developed than her visual spatial abilities (VSI 89). Given her strengths, Aalyah will likely perform much better than her classmates on tasks involving verbal skills, but find it hard to keep up with them on visual spatial tasks. Many children have relatively stronger and weaker areas of ability.*

PERSONIFYING THE PRIMARY ABILITIES: A SIMPLE ANALOGY

In most workplaces, people are hired for specific skills or abilities, and they work together on teams in important ways. Each team member often has a unique ability that is essential to the work the team is performing. Thus, a school team may include a teacher, school psychologist, speech pathologist, nurse, and assistant principal. The team might be asked to determine the best intervention

plan for a struggling learner and they each contribute their unique knowledge, skills, and abilities to the collective plan.

At the risk of oversimplifying, the work of the brain is to learn facts and relationships among them, remember them when needed, and use them to quickly and efficiently solve problems in life. In our analogy the brain has at least five primary team members that correspond, more or less, to the five broad abilities measured by the WISC-V. These team members are the librarian, architect, general manager, clerk, and detective.

VCI: The Librarian

The library shelves contain all of the verbal knowledge that has been crystallized in the brain. When someone comes into the library looking for information, an expert librarian can help to solve their problem by recommending certain books, so the person can retrieve them and access knowledge relevant to the problem at hand. The knowledge base of the librarian can be broad and deep, reflecting all of the information that has been acquired through reading, studying, and listening during her or his life. The librarian knows what information may aid in solving a problem.

If the librarian is not effective, the customer will receive information that does not help solve the problem at hand, is only marginally relevant, or maybe misleading. An effective librarian, will not only provide the best information relevant to the question but will do so with the minimum amount of information required to complete the job, thus not wasting the customer's valuable time and limited resources.

The VCI mainly measures crystalized knowledge and some verbal reasoning. But the librarian must also know where the information is stored and how to retrieve it. Thus, verbal comprehension assumes adequate long-term retrieval functions as well.

VSI: The Architect

The architect prepares blueprints to build things by constructing geometric designs based on spatial relationships. They have the ability to see how things fit together to form a whole, and how those things can be rearranged to form something different. In some cases they do this by simply matching pieces and parts together, but for other jobs they may need to see these relationships in their mind's eye and imagine how they might fit together differently. This is why it is necessary to hire a trained architect for these jobs rather than employee a construction site manager who simply matches the job to a blueprint.

An ineffective architect creates blueprints that do not meet building codes and creates structures that are not structurally sound (does not balance structural load), have limited structural lifespan (e.g., selects wrong materials), are not functional for the stated purpose of the space, or may be aesthetically displeasing (uses

wrong combination of visual details). An effective architect efficiently designs structures using the most appropriate materials that are structurally sound, efficient for the required usage, and are visually appealing. VSI measures visual–spatial reasoning and requires mental rotation and visual working memory.

WMI: The General Manager

The brain is a very busy workplace. It is barraged minute by minute with requests for previous information, new information that needs to be processed, and decisions that must be made. All of these demands can be loosely thought of as "orders from customers" received at a factory. The general manager controls which customer orders the factory workers pay attention to, based on importance, what work is assigned to which departments within the brain, and in what priority the orders get processed. Once the work is completed, the general manager makes sure the remaining clutter is cleared from the shop floor so the next job can be processed efficiently.

An ineffective manager can slow order processing by not allocating sufficient resources or misallocating resources, not assigning work to the proper groups, not reserving sufficient space for new orders, or not maintaining an organized workflow and work environment. An effective manager devises strategies to handle low and high work volumes, is organized, allows systems for multitasking, and provides the correct amount of resources to get the job completed.

The WMI measures ability to sustain focus on incoming stimuli it assigns to the phonological loop or the visual–spatial sketchpad until completely processed, and to clear out facts that are no longer relevant to the next issue processed in order to avoid proactive interference.

PSI: The Clerk

The clerk is often an entry-level employee who is expected only to complete the assigned work as quickly and accurately as possible. The clerk does not decide what to work on. He or she is not expected to make any really important decisions. The job of the clerk is to do what they are told to do, get it done fast, and not make any mistakes. They then move to the next task assigned by the general manager.

An ineffective clerk can incorrectly fill out forms, fail to notice important missing information, or complete work too slowly for organizational efficiency. An efficient clerk completes tasks quickly and efficiently, identifies incomplete, erroneous, or missing information, and quickly learns and adapts to novel procedures. The PSI measures speed of information processing with visual stimuli.

FRI: The Detective

The detective figures things out by considering all the facts, deducing underlying relationships among them, making inductive inferences, and putting relevant

facts together to solve the crime (i.e., the problem). Some facts come from the immediate environment (i.e., the crime scene) whereas other facts are stored in the library (e.g., knowledge of forensics). The detective relies on the librarian for relevant facts stored in the library. He or she relies on the architect to imagine how the items in the room were arranged before the crime. The detective tells the general manager which leads to pursue first, and relies on the general manager to maintain focus on them and selectively ignore facts the detective deems not relevant. The detective relies on the clerk to process all these facts quickly to solve the problem before the criminal gets away.

A good detective knows where to look for clues, quickly integrates complex and sometimes disparate information into a cohesive understanding of the events of the crime. With this information he or she is able to narrow down a list of possible suspects to the one that committed the crime. A hapless detective fails to draw upon relevant knowledge, does not visualize relevant scenarios, cannot prioritize or maintain focus on the most relevant facts, does not process the information in the correct priority while it is still current and relevant, and ultimately draws incorrect conclusions from the various facts at hand—perhaps even arresting an innocent person.

The FRI measures the ability to solve novel problems. It is most closely related to general intelligence, or "*g*," in that it requires successful integration of multiple cognitive abilities working in concert. For the detective to be successful, the librarian, architect, general manager, and clerk must work together as one team with a common goal of solving the problem.

We hope the reader has appreciated our lighthearted attempt at explaining the primary abilities using personifications that are, of course, somewhat unrealistic. To be sure we are taken seriously, however, we refer the reader to Chapter 4 on theoretical foundations, where we discuss in greater depth the abilities measured by each WISC-V primary index in terms of neuropsychological functions, clinical research, models of cognitive information processing, and theories of intelligence.

ISSUES RELATED TO INTERVENTION

Understanding what ability is measured by an index score is the first step toward planning accommodations for a student who is weak in that ability. Knowing how this weakness would be manifested in daily activities in the classroom is the next step to validating the hypothesized weak ability indicated by the test score.

A first line of intervention is to draw upon the student's strong abilities, be they personal strengths or normative strengths, to compensate for weaker abilities. Now, we suggest classroom modifications and teacher-oriented accommodations for children with weaknesses in each of the five major cognitive abilities measured by WISC-V (verbal comprehension, visual–spatial reasoning, fluid reasoning, working memory, and processing speed). In this regard, weaknesses can either be defined normatively or ipsatively; but it is

not necessary that the student be achieving below his or her potential in the context of a discrepancy approach to be considered for one or more of these modifications or accommodations.

Modifications are changes made in the age-appropriate grade-level expectations for a subject or course in order to meet a student's learning needs. These changes might involve developing expectations that reflect knowledge and skills required in the curriculum for a different grade level, or increasing or decreasing the number or complexity of the regular grade-level curriculum expectations, or both. Thus, we may hear a teacher say that, "Given Bill's limited cognitive ability and that he is functioning three grades below his placement in math, he will require a modified arithmetic program over the next year so he can achieve some proficiency with fundamental math operations."

The term *accommodations* is used to refer to the special teaching and classroom assessment strategies, human supports or individualized equipment, or both, required to enable a student to learn and to demonstrate learning. Accommodations do not alter the state curriculum expectations for the grade. The accommodations that the student requires in connection with instruction, assessment, and functioning in the physical environment may be conceptualized as instructional, environmental, or assessment.

Instructional accommodations are adjustments in teaching strategies required to enable the student to learn and to progress through the curriculum (e.g., "Mary will require the use of voice-to-text software to enable her to dictate her assignments to a computer due to her learning disability in written language").

Environmental accommodations are changes or supports in the physical environment of the classroom or the school, or both (e.g., Greg requires modified seating arrangements in the classroom. Provide him with an alternative quiet area or study carrel where distractions from windows, noise, vents, and disruptive students are minimized.)

Assessment accommodations are adjustments in assessment activities and methods required to enable the student to demonstrate learning (e.g., Crystal will require extra time up to 150% of the time to write tests and exams).

This approach to program modifications and accommodations is rooted in a belief that deficits in specific cognitive processes restrict the student's access to the curriculum, and that the cognitive deficit likely cannot be remediated directly. Therefore, the teacher must find ways to teach around the deficit. Empirical support for some of the intervention ideas made in this section is emerging (see Gathercole & Alloway, 2008; Gathercole, Lamont, & Alloway, 2006). Yet, many of these intervention ideas are simply suggested teaching tips intended to be tried and used only if they can be demonstrated to work for an individual student. Thus, single case studies are recommended as one method of providing empirical support for the strategies suggested below on a student by student basis. Methodologies for single case designs exist and are well accepted. In this case, the methodology would include tracking the student's

progress on a series of brief academic probes before and after implementation of one or more of the accommodations or modifications suggested below. This can be an effective and powerful methodology for demonstrating empirical support at the student level, and collections of these studies begin to build a body of evidence. If implemented on a school-wide scale, a data management system that charts progress on frequent academic probes as a function of a series of attempted interventions can be a very powerful administrative and scientific tool. One such software system is aimsweb (Pearson, 2012).

Selection from among the tips offered below can be made based on the pattern of classroom behaviors observed (see below) for learners who have not responded to standard group-level educational interventions (i.e., Tier II of a three tier RTI model), or based on patterns of WISC-V test scores for students in special education or being considered for special education (i.e., Tier III of a three tier RTI model).

The hardest part of the job of assessment for the purposes of intervention is to translate test results into appropriate modifications and accommodations to the student's work in the classroom. Yet, this is the function that teachers rely on the most when they refer their student for a psychological assessment. If there is one major criticism that teachers and other educational personnel make about psychological assessment and the reports that follow, it is that they lack sufficient information to guide the teacher on "what to do next or what to do differently" that will have a positive impact on the child (Mastoras, Climie, McCrimmon, & Schwean, 2011; Schwean et al., 2006).

The interventions tips provided here follow directly from the cognitive abilities that are measured by the WISC-V index scores. For many children, these strategies will not be sufficient if applied in isolation. Targeted academic interventions are also necessary for specific learning disabilities. Examples are interventions to address weaknesses found in the academic skills of reading, written language, and mathematics. Excellent sources for such interventions are Mather and Jaffe (2002), Naglieri and Pickering (2003), Wendling and Mather (2008), and Mather and Wendling (2012). Further examples are interventions to address executive skills, such as organization, time management, self-regulation, and others. Excellent resources for interventions on executive functions are Hale and Fiorello (2004) and Dawson and Guare (2004).

Evidence on the effectiveness of specific educational and academic interventions is assessed and rated by the U.S. Department of Education through panels of experts organized by the Institute of Educational Services. These reviews and ratings can be found on a website called the What Works Clearinghouse: ies.ed.gov/ncee/wwc/.

The intervention suggestions in this chapter are not intended to replace more targeted educational interventions for specific academic conditions such as dyslexia or written language disorders. Rather, these general strategies are intended to supplement specific academic instructional interventions by providing

simple, practical suggestions for teachers whose students may have a weakness in one of the broader cognitive domains measured by the WISC-V.

Although the intervention suggestions in this chapter focus on academics, we remind the reader to always consider the whole child. Modifications and accommodations may also be needed in the area of social-emotional and interpersonal functioning. Although the cognitive factors do not speak as directly to this, it is important to note that children with cognitive weaknesses may also need accommodation in this emotional area to make them successful in school as well. So a child with low verbal skills may have more difficulty communicating effectively with teachers, parents, and peers. Low FRI scores may mean a child needs more time in understanding and getting comfortable with new social situations, etc. Other factors like inhibitory control, persistence, self-efficacy, grit, and executive functions may play a role in emotions.

The bulleted lists of classroom indicators, modifications, accommodations, and assessment strategies are reprinted with permission from the *Special Education Handbook: A Practical Guide for All Teachers* (Elementary Teachers' Federation of Ontario, 2007). An updated version of this publication is in preparation for 2015.

INTERVENTION SUGGESTIONS RELATED TO VERBAL COMPREHENSION

The VCI measures crystallized knowledge and verbal fluid reasoning. Crystallized intelligence, as measured by the VCI, shows a strong and consistent relationship with the development of reading and math achievement. Contributions of crystallized intelligence to writing achievement are important primarily after age 7. Its contributions to reading, math, and writing achievement become increasingly important for reading and math achievement with age (Berninger & Abbott, 2003; Berninger & Wagner, 2008; Flanagan, Alfonso, Mascolo, & Sotelo-Dynega, 2012; Flanagan & Mascolo, 2005).

A student with needs in these areas has difficulty in understanding oral language, or in expressing himself or herself through oral language, or in both. Classroom indicators of this need in the student's daily performance related to verbal comprehension include:

- Having a limited receptive vocabulary needed to understand words and their meaning, or having a limited expressive vocabulary to express thoughts and ideas using language in terms of correct word meanings, or both
- Having difficulty in listening and comprehending oral language, including gleaning the meanings of phrases, sentences, idiom and colloquialisms, despite adequate attention and auditory processing skills
- Having difficulty in speaking in "real-life" situations in an age-appropriate manner

- Having difficulty with language comprehension and usage, evident in their native language and impacting their learning of a second language in similar ways
- Having a limited range of general knowledge and subject-specific knowledge, despite indicators of adequate memory functioning. This limitation is evidenced by limited expression of the ideas and knowledge through oral language

Possible instructional accommodations for children with low verbal comprehension abilities include:

- Keep the language of instruction as simple as possible.
- Provide definitions for all new terms and concepts before teaching the lesson. Be alert for subject-specific terms that the student does not know. Teach the student to keep a separate page at the back of each subject's notebook to write the new terms and their definitions. Advise the student to study the list regularly.
- Teach new vocabulary in the context of information that the student already knows about the topic. Make explicit links to known vocabulary, information, and concepts.
- Provide models for more elaborate language usage when conversing with the student. Respond to their statements by repeating their utterances with revised vocabulary and sentence structure that is more age-appropriate.
- Teach the student how to use the dictionary to look up words to find their meanings. Use grade-appropriate resources, both in book form and electronic format.
- Teach the student how to use a thesaurus to look up words to find synonyms and related words. Use grade-appropriate resources, both in book form and electronic format.
- Ask the student whether he or she understood instructions that were given orally. If he or she did not understand, then
  - Paraphrase the instruction using more simple language
  - Explain the terms used in the instruction
  - Reduce the complexity of the instruction by breaking it down into parts.
- Teach the student to recognize when he or she has not understood an oral instruction or lesson, and to ask for clarification to build understanding.
- Use instructional strategies that are not reliant on language, or that include other formats, such as:
  - demonstrations and modeling to teach concepts and procedures
  - hand over hand guidance for young students, coupled with verbal explanations
  - pictures, graphs, charts
  - maps, diagrams, flow charts, logic models
  - semantic webbing maps.
- Teach the student to create a visual image of what he or she hears to supplement the language with visual and procedural representations.

- Communicate with parents in writing through notes, the student's agenda book, postings on the class website, or by e-mail.
- Check for knowledge gaps when teaching new information and concepts that rely on prior knowledge. Where gaps occur, teach the material as though it were new.
- Permit the student to make an audio recording of explanations given to clarify assignments and projects so he or she can replay it while working and getting assistance from a parent or tutor.

Environmental accommodations for children with low verbal comprehension abilities include the following considerations:

- Seat the student near the teacher and away from noise sources.
- Reduce the background noise against which oral language is heard in order to reduce the possibility of distortions of the speech stream.

Classroom assessment strategies for children with low verbal comprehension abilities include:

- Confirm that the student understands the instructions and directions before beginning a test or project.
- Use assessment methods with reduced demands on verbal output, such as true/false, multiple choice, or short answer.
- Reduce the demands for language comprehension when assessing competencies in mathematics and sciences. Use language and structures that scores low in reading level.
- Minimize the requirement for oral presentations.
- Assign projects whose products are visual representations, models, charts, and other constructions.

Further intervention strategies related to oral language are available in Dehn (2013).

INTERVENTION SUGGESTIONS RELATED TO VISUAL–SPATIAL PROCESSING

The VSI measures visual processing, which may be important for doing higher-level or advanced mathematics, such as geometry and calculus (Flanagan & Mascolo, 2005). A student with educational needs related to visual processing has difficulty in organizing visual information into meaningful patterns and understanding how they might change as they rotate and move through space.

Indicators of a need in the student's daily performance related to visual processing may include the following behaviors:

- Having difficulty making visual images to "see something in the mind's eye"
- Having difficulty remembering and differentiating left and right

- Having difficulty manipulating simple visual patterns or maintaining their orientation to see things in space
- Having difficulty mentally manipulating objects or visual patterns to see how they would appear if altered or rotated in space
- Having difficulty in combining disconnected, vague, or partially hidden visual information patterns into meaningful wholes
- Having difficulty finding a path through a spatial field or pattern
- Having difficulty in estimating or comparing visual lengths and distances without measuring them
- Having difficulty understanding math concepts in geometry, calculus, and other higher math
- Having difficulty in remembering letter formations and letter patterns
- Having difficulty in reading charts, maps, and blueprints and extracting the needed information
- Having difficulty arranging materials in space, such as in their desks or lockers or rooms at home
- Missing visual details
- Having difficulty copying information from far point, like the blackboard, or from near point, like texts

Possible instructional accommodations for a weakness in visual processing abilities include:

- Reduce the number of visual displays involving manipulative materials, drawings, diagrams and charts that could overwhelm the student, and replace them with clear verbal instructions.
- Explain in words all new skills and concepts, and all graphics and visually-based concepts and tasks.
- Provide the support of clear verbal instructions for tasks requiring spatial organization.
- Encourage the student to use verbal mediation to talk themselves through visual or spatial work.
- Teach the student to write from left to right. Use a green for "go" margin on the left side of the paper where the student begins to write. Use a red for "stop" line at the right edge of the paper.
- Do not require the student to use any visual strategies that he or she finds confusing, such as webs, diagrams, charts, and schemas for math operations.
- Provide activities with manipulative materials, particularly in the primary grades.
- Replace copying from the blackboard with providing copies of the notes or assignments.
- When copying is required, do not require speed. Allow extra time for the student to proofread for accuracy.

- Provide math exercises on worksheets with only a few questions and plenty of white space. Do not require the student to copy problems from the blackboard or textbook.
- Teach the student to use verbal mediation, by saying each word or number or detail when copying from far point to paper.
- Provide extra visual structure on worksheets and assignments. Use organizers like numbered boxes, or colour codes where instructions and similar questions have the same colour.
- Provide graph paper and lined paper to use for completing math exercises while the student learns how to line up numbers by place value.
- Teach the student how to interpret the organization of a page of text having an unusual format by using numbers to identify the sequence, or colours to link related information.
- Provide Direct Instruction in reading and interpreting maps, graphs, charts, and diagrams.

Environmental strategies that may be considered when working with children who have visual processing deficits are:

- Keep work space free from extraneous distractions, by removing all visual clutter that is not necessary to the task.
- Ensure that the student clears his or her desk completely before beginning a task. Remove all visual clutter from the work space before assembling the materials needed for the current task.
- Ensure that presentations using colours have enough contrast to be distinguishable in all light conditions.
- Modify colour usage in visual presentations to avoid reliance on colour coding for students with deficits in colour vision.

Classroom assessment strategies for children with weaknesses in visual processing abilities include the following suggestions:

- Put few math questions on each page, with a lot of white space for calculations on math tests.
- Provide manipulative materials when testing concepts involving spatial relationships.
- Emphasize verbal and written answers, rather than charts, diagrams and maps, where possible.
- Permit students to explain spatial information from their perspective without the requirement to rotate it to the examiner's point of regard.
- Reduce the emphasis on charts and mapping, unless that is the skill being taught and evaluated.
- Relax standards of production for art assignments and accept approximations of accepted criteria.
- Do not penalize the student for placing information incorrectly on a page.

Further intervention strategies related to visual–spatial thinking are available in Dehn (2013).

INTERVENTION SUGGESTIONS RELATED TO FLUID REASONING

The FRI measures fluid reasoning. Fluid reasoning shows a strong relationship with the development of math achievement, and contributes moderately to the development of reading skills. In the elementary grades it contributes moderately to basic writing skills, and at all ages it relates to written expression (Flanagan & Mascolo, 2005). A student with needs related to fluid reasoning has difficulty when faced with relatively novel tasks that require reasoning, recognizing and forming concepts, and drawing inferences (Elementary Teachers' Federation of Ontario, 2007).

Indicators of this need in the student's daily performance related to fluid reasoning may include:

- Having difficulty recognizing, forming, and understanding concepts
- Having difficulty perceiving relationships among patterns
- Having difficulty drawing inferences from information that is presented
- Having difficulty understanding the implications of an issue or an action
- Having difficulty with complex problem solving and concept formation
- Having difficulty understanding and using "and logic"
- Having difficulty understanding and using "or logic"
- Having difficulty with extrapolating, or following a logical pattern through to another conclusion
- Having difficulty with quantitative reasoning needed for understanding and computing mathematics
- Relying heavily on the use of language to aid in their comprehension of concepts and to solve problems that are new to them and cannot be solved automatically
- Having difficulty understanding the Piagetian concepts of conservation and classification
- Having difficulty transferring and generalizing information to new situations

Consider the following instructional strategies when working with children who demonstrate a weakness in fluid reasoning in the perceptual domain:

- Provide verbal instructions to all tasks (assuming verbal skills are adequate).
- Use teaching approaches that promote the development of self-talk to mediate all tasks.
- Rely on the student's verbal memory skills to teach problem-solving through repetition and rote recall.
- Present concepts and procedures verbally, in a straightforward fashion to ensure comprehension.

- Teach strategies for solving problems, paying close attention to the proper sequence of events that can be memorized as verbal instructions.
- Provide repetition and review of concepts to ensure over-learning. Check that a student's memory for material includes comprehension.
- Teach mechanical arithmetic in a systematic, verbal, step-by-step fashion.
- Use real objects and manipulative materials, along with verbal descriptions to teach concepts.
- Teach strategies to increase understanding and retention of concepts, including:
  - self-talk, so the student guides himself or herself through the problem verbally
  - lists of procedures or steps to follow.
- Teach problem-solving techniques in the contexts in which they are most likely to be applied.
- Teach and emphasize reading comprehension skills as early as possible so the student may rely on reading and rereading to ensure comprehension of concepts.
- Teach verbal strategies that will help them to organize their written work into sequential steps.
- Structure and adjust the difficulty level of the task, where possible.
- Explain homework and assignments in a sequential, step by step, fashion.
- When teaching concepts or providing instructions, avoid:
  - complicated and lengthy instructions and directions
  - figurative language, since the student is likely to interpret language literally
  - complex instructions.
- Watch for associated problems with organizational skills and follow instructional strategies for organization, if needed.
- Watch for associated problems with social skills, and provide interventions, if needed.

For children with deficits in fluid reasoning there are no obvious environmental strategies. However, the following classroom assessment strategies may be considered:

- Initially, rely more on verbal instructions and less on charts, maps, and diagrams.
- Pair verbal explanations with visual material to make use of the child's relative strength in verbal reasoning to help them learn how to interpret and organize visual information.
- Ask clear, specific questions, rather than asking open-ended questions or asking students to make inferences.
- Rely more on verbal responses and less on the production of charts, maps, and diagrams.

- Test for knowledge of the material, where possible.
- Ask the student to show all of their work (e.g., complete math calculations, or the outline for a long answer). Give partial marks for the process they followed.
- Provide a scoring rubric to the student so he or she knows how many marks they got for their knowledge, and how many they got for applications and problem solving using the knowledge.
- Use test formats that the student knows to ensure the use of the right problem-solving strategies to answer the questions.

Further intervention strategies related to fluid reasoning are available in Dehn (2013).

INTERVENTION SUGGESTIONS RELATED TO WORKING MEMORY

How do marked working memory deficits affect classroom activities? Two observational studies are informative. The first study involved a group of children with low working memory but typical scores in general ability measures (Gathercole, Alloway, Willis, & Adams, 2006). Compared with classmates with typical working memory skills, the low working memory children frequently forgot instructions, struggled to cope with tasks involving simultaneous processing and storage, and lost track of their place in complex tasks. The most common consequence of these failures was that the children abandoned the activity without completing it. A detailed description of common characteristics of low working memory children in the classroom is in Gathercole and Alloway (2008) and Gathercole et al. (2006). The second observational study by these authors drew a selection of children from the screening study described above. They were observed in mainstream primary classrooms in demographically diverse areas that included children with either low or average working memory skills. Examples of frequently observed behaviors that corresponded to working memory deficits included: "The child raised his hand but when called upon, he had forgotten his response"; "She lost her place in a task with multiple steps"; and "The child had difficulty remaining on task." Children with poor working memory struggled in many classroom activities, simply because they were unable to hold in mind sufficient information to allow them to complete the task. Losing crucial information from working memory caused them to forget many things: instructions they are attempting to follow, the details of what they are doing, where they have got to in a complicated task.

In the observational study described above (Gathercole et al., 2006), children with poor working memory function often gravitated towards lower-level strategies with lower processing requirements resulting in reduced general efficiency. For example, instead of using number aids such as blocks and number lines that are designed to reduce processing demands, these children relied on more error-prone strategies like simple counting instead.

Frequent failures of children with low memory to meet the working memory demands of classroom activities may be at least one cause of the poor academic progress that is typical for them. In order to reach expected attainment targets, the child must succeed in many different structured learning activities designed to build up gradually across time the body of knowledge and skills that they need in areas of the curriculum such as literacy and mathematics. If the children frequently fail in individual learning situations simply because they cannot store and manipulate information in working memory, their progress in acquiring complex knowledge and skills in areas such as literacy and mathematics will be slow and difficult.

For a review of working memory, from theories to assessment approaches and measures, to its impact on various academic skills to intervention strategies for working memory, see Dehn (2008) and Dehn (2015). A further resource is Alloway (2011). Further intervention strategies related to working memory are available in Dehn (2013).

Indicators of a need in the student's daily performance related to difficulties with working memory may include the following behaviors:

- Having difficulty following directions beyond the first steps
- Forgetting what they have to do next
- Difficulty with sentence writing
- Losing his or her place in complex activities
- Having difficulty with writing sentences or paragraphs
- Having difficulty with mathematics computations that involve more than one step, such as long division
- Having difficulty attending to and immediately recalling information they have just seen or heard

Possible interventions and instructional accommodations for children with working memory difficulties are discussed below.

The ideal solution to ameliorate the learning difficulties resulting from impairments in working memory would be to remediate the memory impairment directly. There is increasing evidence that directly training working memory with digital working memory training programs such as CogMed can lead to improvement on nontrained working memory tasks (Holmes, Gathercole, & Dunning, 2009; Klingberg, Fernell, Olesen, Johnson, & Gustafsson, 2005; Klingberg, Forsberg, & Westerberg, 2002), and perhaps in academic attainment as well (Holmes et al., 2009), although some researchers remain unconvinced (Melby-Lervåg & Hulme, 2012), and the debate continues (Shinaver, Entwistle, & Söderqvist, 2014). These programs capitalize on the well-accepted principle of neuroplasticity, which postulates that the brain can grow new connections based on experience. Working memory training programs are indirectly supported by basic neuroimaging research that relates increases in cognitive ability to the development of cortical thickness in healthy children and adolescents (Burgaleta, Johnson, Waber, Colom, & Karama, 2014).

The active ingredients of working memory training programs are carefully constructed tasks that directly stress the working memory structures, algorithms that constantly adjust item difficulty to the upper limit of the student's ability, and effective coaching to keep students motivated during the training. When implemented with fidelity, the CogMed program can be an effective adjunct to a comprehensive psychoeducational intervention program. However, it is unreasonable to expect achievement to improve immediately when working memory abilities remediate. Rather, once the student's working memory capacities increase, the student may be better able to access the curriculum through effective instruction over the following semester.

Thus, in addition to direct training, we recommend a number of classroom management techniques to minimize memory-related failures in classroom-based learning activities frequently experienced by children with working memory impairments.

- First, ensure that the child can remember what he or she is doing, to avoid failure to complete all steps of a learning activity. Strategies include:
  - Use instructions that are as brief and simple as possible. Break instructions down into individual steps where possible.
  - Repeat the instructions frequently.
  - For tasks that take place over an extended period of time, remind the child of crucial information for that phase of the task instead of repeating the original instruction.
  - Ask the child to repeat critical instructions back to you.
  - Since children often have good insight into their working memory failures, check with the child to make sure he or she remembers what to do.
- To help students to follow instructions:
  - Give brief and simple instructions with limited extraneous verbalization.
  - Break down instructions into simple steps when possible. Use numbered points for any sequence.
  - Reduce the number of steps given at one time.
  - Repeat instructions frequently.
  - Ask the child to repeat the instructions to ensure that they are remembered.
  - Give specific reminders targeted to the current step in a multi-step task.
- To prevent a child from losing his or her place in a complex task:
  - Decompose tasks into discreet steps.
  - Encourage older students to practice and actively use memory aids.
  - Provide support for use of external memory aids.
  - Encourage the student to ask for forgotten information.
- To improve the learning successes of individuals with poor working memory skills teach them self-help strategies to promote their development as independent learners who can identify and support their own learning needs. Teach them to develop effective strategies to cope with working memory failures, including:
  - Encourage the child to ask for forgotten information where necessary.

  - Train the child in the use of memory aids.
  - Encourage the child to continue with a complex task rather than abandoning it, even if some of the steps are not completed due to memory failure.
- Provide supports for spelling frequently occurring words. This will prevent children from losing their place in the complex task of writing activities.
  - Reducing the processing load and opportunity for error in spelling individual words will increase the child's success in completing the sentence as a whole. However, reading off information from spellings on key words on the teachers' board was itself observed to be a source of error in low memory children in our study, with children commonly losing their place within the word.
  - Making available spellings of key words on the child's own desk rather than on a distant board may reduce these errors by making the task of locating key information easier and reducing opportunities for distraction.
  - Develop ways of marking the child's place in word spellings as a means of reducing place-keeping errors during copying.
- For writing tasks:
  - Reduce the linguistic complexity of sentences to be written.
  - Simplify the vocabulary of sentences to be written.
  - Reduce the length of sentences to be written.
  - For older students, introduce use of outlines and techniques to keep place in the outline when writing.
- Teach memory aids, such as verbal mediation or rehearsal, and mnemonic strategies, such as:
  - Dracula's Mother Sucks Blood, to cue the order of operations in long division (Divide, Multiply, Subtract, and Bring down)
  - Every Good Boy Deserves Fudge, for the names of the lines in the treble clef music staff
  - the method of loci to match items with landmarks on the route to school.
- Teach the student to use lists, advance organizers, personal planners as aids to memory.
- Communicate frequently with parents about school activities, equipment needed, homework, and assignments through a communication book or regular e-mail.
- Provide notes to the student from presentations and lectures.

Environmental accommodations for children with working memory problems:

- Reduce opportunities for distraction and reduce the number of distractions in the vicinity.
- Provide visual reminders and other memory supports for multi-step tasks.
- Attach the student's daily schedule or timetable to the notebook cover that the child takes home every day.

- Post the student's daily schedule or timetable on the student's desk or classroom wall. Send a copy of the schedule or timetable home for posting in the student's room or on the fridge.

Assessment accommodations:

- Allow the student to use appropriate memory supports during testing. Supports would typically provide information about procedures to use, rather than providing content that the student should know.
- Use open-ended questions with more than one correct answer to allow for marks for anything the student remembers.
- Reduce the demands on working memory on tests by providing a structure and outline for responding.

INTERVENTION SUGGESTIONS RELATED TO PROCESSING SPEED

Processing speed shows a strong relationship with the development of reading and math achievement, especially during the elementary school years when children are learning the skills in reading and math, and developing speed and automaticity in their use (Flanagan & Mascolo, 2005). Older school children use these basic academic skills with automaticity, and integrate them with more complex tasks such as problem-solving, subject-focused writing, and complex reading. When mental efficiency in focusing concentration is required, students with slower processing speed have difficulty performing simple cognitive tasks fluently and automatically. Indicators of this need in the student's daily performance related to the speed with which he or she processes information and completes tasks include:

- Being slow to perform basic arithmetic operations, not learning the times tables, and not attaining automaticity in calculations and so uses fingers or counters
- Taking longer to complete assignments in class
- Not finishing tests and exams within the time allotted
- Not finishing a copying exercise within the time allotted
- Reading slowly
- Taking even more time to complete tasks under pressure
- Coming to the right answer, but taking longer to do it

Consider the following possible instructional accommodations when processing speed is a weakness:

- Allow the student longer response times:
  - to respond orally to questions asked in class
  - to make decisions when offered a choice of activities
  - to complete assignments in class.

- Do not require the student to work under time pressure.
- Reduce the quantity of work assigned in favour of quality productions.
- When copying is required, do not require speed. Allow extra time for the student to proofread for accuracy.
- Provide the student with ample time to complete his or her work, or shorten the assignment so it can be accomplished within the time allotted.
- Provide extra time for the student to complete in-class assignments in a way that does not bring negative attention to him or her.
- Shorten drill and practice assignments that have a written component by requiring fewer repetitions of each concept.
- Provide copies of notes rather than requiring the student to copy from the board in a limited time.
- Provide instruction to increase the student's reading speed by training reading fluency, ability to recognize common letter sequences automatically that are used in print, and sight vocabulary.
- Teach the student how to monitor time spent on each task. The student could use a stopwatch or timer. He or she could record the start and end times on paper. Set a goal for the student to gradually reduce the time needed to do each task.
- Provide timed activities to build speed and automaticity with basic skills, such as:
  - reading a list of high-frequency words as fast as possible
  - calculating simple math facts as fast as possible
  - learning simple math calculations through flash cards and educational software exercises
  - charting daily performance for speed and accuracy.

In the classroom and other settings where the student does tasks such as homework, provide environmental accommodations:

- Reduce environmental distractions to improve performance.

When taking tests in the classroom consider the following strategies for assessment accommodations to obtain maximum performance:

- Emphasize accuracy rather than speed in evaluating the student in all subject areas.
- Do not use timed tests for evaluation. Instead, use assessment procedures that do not rely on speed.
- Allow a specified amount of extra time for tests and exams (usually time and a half).
- Provide supervised breaks during tests and exams.
- Break long tests into more sittings of shorter duration across a few days.
- Provide a reader or text-to-voice app to read test and exam questions to a student to accommodate for slow reading fluency.
- Provide a voice-to-text app to record the student's answers on tests to accommodate for slow writing fluency.

- Use test and exam formats with reduced written output formats to accommodate for slow writing fluency.
  - Examples include: multiple choice formats; true/false formats; and short answer formats where a student fills in the blank.

Further intervention strategies related to processing speed are available in Dehn (2013).

Comment on Intervention Suggestions

Younger children have a lot of support available in the classroom in the form of various aids, such as visual displays of number lines, letters, and rhymes. Once children get older, learning becomes more autonomous and there are fewer opportunities to rely on external supports. For instance, while memory aids such as dictionaries and spelling charts are still available, there is less repetition of instructions, fewer visual cues such as number lines or multiplication tables, and more individual rather than group or supervised activity. At the same time, instructions become lengthier, classroom lessons become more complex, and specific cognitive demands become greater. The combination of these factors can serve to widen the gap in performance between children with average abilities and those with specific impairments as they grow into adolescence and enter middle and high school settings.

The strategies described above for modifying the environment and classroom assessment demands, and differentiating the style of instruction are appropriate for children of all ages. For some children with cognitive processing deficits these modifications and accommodations are necessary to ensure that they have equal access to the curriculum. As these children age, however, they need to be directly taught compensatory strategies that they can employ on their own across environments. Thus, general recommendations for improving the learning successes of children with a weakness in one of the domains of cognitive ability are to encourage them to develop their own learning strategies, and to take advantage of available classroom resources. Strategies may include encouraging the child to ask for forgotten information where necessary, training the child in the use of memory aids, and encouraging the child to continue with complex tasks rather than abandoning them, even if some of the steps are not completed due to memory failure. Providing children with such self-help strategies will promote their development as independent learners able to identify and support their own learning needs. The following case example provides a clear demonstration.

CASE EXAMPLE

Mariana is a 10-year-old girl with an impairment of working memory. Her teacher requested a psychoeducational assessment when she observed that Mariana's achievement and progress in class was somewhat variable. She

showed difficulty when required to use both new and previously acquired information to address new questions and especially to continue to build on these themes by revisiting and modifying previous solutions. These difficulties were observed in subjects ranging from social studies to mathematics and seemed to occur mainly when the task involved more "mental" than "paper and pencil" work.

The psychologist reported that Mariana's earned average scores on the WISC-V were VCI (104), VSI (110), FRI (98), and PSI (99). However, her WMI (82) was significantly lower compared to her average scores on the other index scores. The base rate tables showed that very few children in the average ability range demonstrated such a large discrepancy between the WMI, VCI, and VSI. Of particular interest was that Digit Span Backwards (DSB) and Digit Span Sequencing (DSS) were both relatively weak scores for Mariana in contrast to average Digit Span Forward (DSF). Thus, her classroom achievement, under particular learning conditions, was being compromised by her verbal working memory difficulties. Mariana's classroom learning would require support with visual prompts and cues, as well as the pacing of material. She will also require support to develop strategies for managing tasks that required greater demands on verbal working memory.

Mariana was observed in a numeracy lesson in which there were 10 pupils of relatively similar ability who were split into two groups. The lesson began with the children sitting at their tables for the "mental math" session in which the class played "What number am I?" The teacher reminded the children how to play the game as she encouraged them to ask focused questions about the number she was thinking of. She modeled examples of questions that could be asked to help the children work out her number, e.g., "Is the number less than 20?" and emphasized the use of specific mathematical vocabulary before giving volunteers the opportunity to lead the game.

Mariana participated well when asking questions about other pupils' numbers, though she did ask the same type of question each time. Her questions were all based on an example that had been modeled by the teacher, e.g., "If I partition it, will it be 30 and 3? Does it partition into 20 and 4? Does it partition into 70 and 2?" She was also keen to take the leading role part-way through the game. However, as soon as the other pupils began to ask questions about her number, she quickly lost her enthusiasm to participate. When asked, "Does the number have eight 10s?" Mariana did not respond. The teacher repeated the question and reminded her to think of the place value of her number, giving the prompts "Does your number have 10s? Do you know how many 10s there are?" Mariana was evidently struggling to hold the number in mind while attempting to answer questions about it. She eventually told the teacher that she had forgotten it. At this point, the teacher spent a few minutes revising the concept of place value. She referred the children to the 100 square and the place value chart as she asked key questions such as "How many 10s does a number in the 80s have?" and "If a number has six 10s, which row do we point to on the

100 square?" Mariana successfully answered this question, making good use of the visual aids available.

As this took place, the teacher constantly repeated crucial information such as the key vocabulary (more than/less than) and asked target questions to help the children gain greater understanding of the concepts being taught, e.g., "If we are working out 10 more/less than a number, which part of the number changes?" She often directed such questions toward Mariana to support her thinking processes. For instance, "When thinking about 10 less than 307, Mariana, which part of the number will stay the same?"

Mariana correctly stated "7."

"Which part of the number will change?"

Mariana replied: "The 30. It gives 29."

As this main part of the lesson developed, Mariana became increasingly more distracted and appeared to lose total concentration. She began to swing on her chair, talk to her neighbor and shout out random comments unrelated to the task. The teacher reminded Mariana on several occasions to follow the usual classroom routines and actually stopped the class at one point to reinforce her expectations of behavior: "Stop talking. Put your pens down. Listen to me when I'm talking and put your hand up if you have something to say."

These instructions were clearly delineated by the teacher as she simultaneously pointed to the classroom rules displayed on the wall, thus allowing the children time to store and process the information.

During the lesson, students were challenged to perform simple calculations using some of the mental strategies taught in previous lessons. They were encouraged to use the tables' charts, number lines, and 100 square and to note key information on their whiteboards to help them in their calculations. Mariana responded well and made excellent use of these visual strategies to support her working memory. For example, she regularly referred to the poster to help her remember multiplication facts, used her fingers to count on from a given number when performing additions, and used diagrams to calculate divisions.

Here, we see that the teacher regularly repeated key questions to Mariana so that she would not fall behind in understanding the mathematical concepts. This is also a good example of how to encourage children to develop and use strategies to support their learning as Mariana was able to complete the activity on her own.

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