

wisc-IV
Integrated



Working Memory Domain Case Study

“Steven has been experiencing behavior problems at school and his teacher suspects that he may have underlying learning and emotional issues that are contributing to his difficulties.”



Steven is in many ways a typical 12-year-old. He enjoys playing baseball in a city league, likes going camping with his family, and is proud of his skill in building model rockets.

Unfortunately, he has not achieved the same level of success in school, where he is struggling to pass his language arts and social studies classes. In fact, he is having so much difficulty in learning new content from his textbooks that his teachers are considering a recommendation for retention.

Case Study No. 3



Meet Steven...a talkative, active 12-year-old boy who is often impulsive. Although he has average cognitive skills, Steven has trouble listening and following verbal directions. He has problems registering new information in his short-term memory and recalling it for a particular purpose. When tasks become overwhelming for Steven he tends to shut down. He speaks at a normal rate but in a monotone.

Steven was first identified as an at-risk student in the spring of fifth grade when he scored in the bottom 20% of students in his grade on the AIMSweb Reading-CBM benchmark. After-school tutoring twice weekly for 30 minutes per session with his classroom teacher was initiated with bi-weekly progress monitoring. His progress was slow and summer school was recommended. Steven was unable to attend, however, because he spent the summer with his grandparents in another state.

His scores on the fall reading benchmarks again identified him as being at-risk (now in the bottom 15% of sixth graders) and the campus Pupil Intervention Team (PIT) referred him to the reading specialist for 30 minutes of intervention daily using core curriculum materials. When he did not show adequate progress after 12 weeks of intensive intervention, the PIT requested an individual comprehensive assessment to better understand why he was not responding and to identify if he has specific educational needs that should be addressed in the classroom.

According to Steven's teachers, his problems at school include difficulty listening and following directions, reading grade-level text with comprehension, meeting expectations in the preparation of compositions or written responses to demonstrate what he has learned, and completing long-term assignments (i.e., book reports). His teachers also observe that Steven is often talking when he should be working.

His parents report similar concerns at home in that Steven often does not remember his chores or starts his chores and does not complete them. He complains about assigned reading and refuses at times to complete written assignments. Both parents and teachers describe Steven as a bright youngster who they believe needs to work harder at school. As part of this assessment, Steven was administered the WISC®-IV Integrated (Wechsler Intelligence Scale for Children®-Fourth Edition Integrated).

During the test sessions, Steven was observed putting forth good effort but becoming frustrated on tasks that required him to listen carefully then repeat information he had heard. This task was especially difficult when he had to reorder or reorganize the information prior to recitation. He demonstrated good expressive language but tended to go off topic on verbal tasks providing more information than requested. He frequently asked to have questions repeated or clarified prior to responding. He required encouragement to stay engaged on difficult tasks and frequently asked if his response was correct and if he had to continue.

Overall, Steven's cognitive abilities are within the average range. His Full Scale IQ score on the WISC-IV Integrated, which is attenuated somewhat because of the significantly lower WMI score, falls at the 63rd percentile and suggests that he should be able to master grade-level content. At the same time, there is a significant difference between his WMI score and of the

Steven's efforts earned him the following scores:

WISC®-IV INTEGRATED (WECHSLER INTELLIGENCE SCALE FOR CHILDREN®-FOURTH EDITION INTEGRATED)

	Composite Score	Percentile Rank
FULL SCALE IQ	105	63

INDEXES

Verbal Comprehension	108	70
Perceptual Reasoning	112	79
Working Memory	80	9
Processing Speed	109	73

VERBAL COMPREHENSION SUBTESTS

	Scaled Score	Percentile Rank
Vocabulary	11	63
Similarities	12	75
Comprehension	12	75

PERCEPTUAL REASONING SUBTESTS

Block Design	11	63
Picture Concepts	12	75
Matrix Reasoning	13	84

WORKING MEMORY SUBTESTS

Digit Span	6	9
Letter-Number Sequencing	7	16
Sequencing Arithmetic	6	9

PROCESSING SPEED SUBTESTS

Coding	10	50
Symbol Search	13	84

other index scores. This pattern of performance is highly unusual, occurring in less than 5% of the standardization sample.

Steven demonstrates cognitive strengths in his ability to engage in nonverbal reasoning tasks as demonstrated by his high scores on [Matrix Reasoning](#) and [Picture Concepts](#), on which he was required to analyze and synthesize abstract visual stimuli, both with and without time limits. He also performed well on measures of processing speed, on which he was required to visually scan, discriminate, and reproduce abstract symbols quickly. His verbal reasoning skills were average to high average and he was able to use his expressive language abilities to define words, demonstrate verbal concept formation, tap into his fund of general knowledge, and show an understanding of conventional standards of behavior and social judgment.

Steven's low average performance on the [Working Memory](#) subtests is remarkable in comparison with his other scores. Specifically, he was not able to recall a series of numbers he had heard ([Digits Forward](#)) as well as others students his age could; his performance on this task yielded a scaled score of 7 (16th percentile rank). His poor performance declined even more when he was required to reverse the series of numbers prior to recitation ([Digits Backward](#)); on this task, he earned a scaled score of 6 (9th percentile rank). These two tasks together are represented by the [Digit Span](#) subtest score of 6.

Steven was visibly upset by his performance and commented that he wasn't "good at remembering things." These scores suggest that Steven has a limited auditory recall span—he could recall only a series of four digits in correct order forward whereas most children his age would recall five to seven numbers sequentially. Similarly, he recalled only three digits in correct reverse order, a task that requires not only registration of the digits in short-term memory, but the manipulation of those numbers in working memory. These results indicate difficulties with both the registration and manipulation of auditory information.

In similar fashion, he had considerable difficulty on [Letter-Number Sequencing](#), a more demanding auditory working memory task that required him to listen to a mixed series of numbers and letters, then repeat the series by giving the numbers first in numerical order followed by the letters in alphabetical order. He was able to recall only a series of three items and demonstrated similar difficulty with letters and numerals. Steven also was given the supplemental [Arithmetic](#) subtest, on which he was asked to mentally solve a series of orally presented arithmetic problems. His score of 6 is similar to his scores on the other working memory subtests. Although he made few calculation errors, he took considerable time to respond and talked his way through solutions.

To better understand the nature of Steven's working memory deficits, data from the following WISC-IV Integrated subtests were obtained: [Visual Digit Span](#), [Spatial Span](#), [Letter Span](#), [Letter-Number Sequencing Process Approach](#), [Arithmetic with Time Bonus](#), and [Arithmetic Process Approach-Part A](#) and [Part B](#).

**WISC-IV Integrated
(Wechsler Intelligence Scale for Children-Fourth Edition Integrated)**

Subtest	Scaled Score	Percentile Rank
Digit Span Forward	7	16
Digit Span Backward	6	9
Visual Digit Span	11	63
Spatial Span Forward	11	63
Spatial Span Backward	12	75
Letter Span Non-Rhyming	7	16
Letter Span Rhyming	4	2
Letter-Number Sequencing PA	7	16
Arithmetic with Time Bonus	6	9
Arithmetic PA Part A	8	25
Arithmetic PA Part B	10	50

Steven's performance on the visual and spatial working memory tasks was consistently better than that on auditory tasks. [Visual Digit Span](#) was significantly better than [Digit Span Forward](#) and [Spatial Span Backward](#) was significantly better than [Digit Span Backward](#). When information is visual or visual-spatial, Steven is able to overcome the challenges he faces with verbal-only input and is able to register and manipulate information as well as his age mates can. Another difference is that on [Visual Digit Span](#) he was able to view all of the numbers at once rather than receiving them one at a time. The visual presentation allowed him to chunk or group the numerals for easier recall.

Similarly, his performance on the verbal-only [Arithmetic](#) subtest improved significantly when he was able to perform the calculations with paper and pencil. When the working memory demand was significantly reduced, his score moved into the average range. It is also interesting to note that providing an opportunity for time bonuses did not improve his arithmetic score, whereas increasing accommodations to facilitate performance did.

On the verbal-only [Letter Span](#) task, Steven had considerable difficulty recalling phonologically similar letter series, suggesting problems with auditory processing and discrimination as well as working memory. Further, on Letter-Number Sequencing PA, he did not benefit from the reduced working memory demands offered by words that were embedded in the items.



His reading comprehension was notable for his relatively good ability to figure out the general point of the story but he had difficulties with recalling specific details.

The primary difference between his performance on working memory tasks was the characteristics of the incoming information.

WIAT-III (Wechsler Individual Achievement Test-Third Edition)

Subtests/Composite	Standard Score	Percentile Rank
Word Reading	90	25
Pseudoword Decoding	84	14
Oral Reading Fluency	88	21
Reading Comprehension	93	32
Basic Reading Composite	87	19
Reading Comprehension & Fluency Composite	87	19
Total Reading Composite	85	16
Math Problem Solving	110	75
Numerical Operations	108	70
Mathematics Composite	110	75
Spelling	78	7
Sentence Composition	88	21
Essay Composition	90	25
Written Expression	82	12

Steven also was given the reading, math, and writing subtests from the WIAT®-III (Wechsler Individual Achievement Test®-3rd Edition). His performance was inconsistent across subtests, with his best performance on the math subtests and his lowest performance on the writing subtests. Further, his performance on both the reading and writing sections is significantly below expectation based on his cognitive ability score.

Steven was asked to complete four different reading tasks and each of his scores fell at or below the 25th percentile ranking. [Word Reading](#) required him to read aloud words of increasing difficulty from a word list. Even though his score falls within the average range, he did not read many of the words automatically, stumbled over unfamiliar but decodable words, and often guessed based on initial letter or word configuration. He tended to recognize known words immediately but had few decoding strategies for unfamiliar words.

When asked to read aloud from a list of nonsense words on [Pseudoword Decoding](#), he had considerable difficulty even on the easier items. He often substituted a visually similar real word for the decodable nonsense word. He missed items most often because of vowel errors. When asked to read grade-level passages aloud on the [Oral Reading Fluency](#) subtest, Steven lacked prosody as he read in spurts—reading words he knew quickly, then pausing on unknown words.

At times, he used context clues to identify a word and was more likely to substitute another word that fit the context than to correctly read the unknown word. As the task progressed he became quieter as he read until he could barely be heard. His demeanor changed and he became less confident and appeared to be embarrassed by his slow, laborious decoding and many oral reading errors. Despite his inaccurate and slow oral reading, he was able to answer the comprehension questions correctly.

Likewise, he earned a low average score on the [Reading Comprehension](#) subtest, on which he read silently then answered questions about what he had read. In spite of his poor phonological processing (e.g., decoding) skills, Steven is able to call upon his verbal reasoning strengths to identify the main idea from text, however his poor decoding interferes with his ability to recall specific details or detect inferred information.

Steven's math scores on [Math Problem Solving](#) and [Numerical Operations](#) reveal his academic strength. These scores are consistent with his performance on the WISC-IV Integrated Arithmetic PA Part B score, on which he was able to calculate problems correctly when paper and pencil are provided as opposed to using working memory to solve problems in his head. His strong reliance on visual input was evident when he drew information prior to setting up the calculation on more complex word problems even though employing the strategy added time to problem solution.

Steven's phonological processing deficits were evident in his poor performance on the [Spelling](#) subtest, on which he was unable to spell decodable as well as irregular words. His low scores in the area of written expression are consistent with his identified working memory deficits in that writing places heavy demands on

verbal working memory, phonological short-term memory, and visual working memory. He was able to combine multiple sentences into one while maintaining meaning and to generate sentences using target words on [Sentence Composition](#). However, his spelling and punctuation errors contributed to his lower score.

As evidenced by his abbreviated essay, Steven is also reluctant to write—in part because he is overly concerned about the mechanics required (i.e., spelling). As a result, he tends to use words he can spell, thereby producing writing products typical of a much younger student, so that his lower score on [Essay Composition](#) is the result of mechanical errors as well as weak sentence structure, content, and organization.

Steven demonstrates a pattern of significant cognitive strengths as well as cognitive weaknesses, most notably in the area of working memory. His working memory deficits appear to be specific to tasks for which information is only verbal, in which case he has problems registering the new information in short-term memory, manipulating it using working memory, and recalling it for a particular purpose. In addition, he has not mastered the necessary phonological skills to be able to decode grade-level words to support learning through reading. His auditory/verbal working memory deficits, when paired with his weak phonological processing skills, have interfered with his ability to profit from code-based reading instruction.

Because he is able to gain some meaning from what he reads as a result of his strong verbal reasoning abilities, Steven is also not highly motivated to invest in learning to decode more effectively. The same deficits have affected the development of spelling skills. Because he has been unable to juggle the high working memory demands and the low-level requirements of mechanics and spelling, along with the demands for planning, organization, and theme development, he now avoids writing.

The results of this evaluation, including the following recommendations, will be shared with Steven, his parents, and his teachers. Because of his age, intensive intervention is strongly recommended.

1. Older students with decoding deficits typically respond best to a top-down intervention approach. Successful programs target brain

developmental areas (e.g., frontal lobes) and address skills such as planning, organization, strategy formation, and self-monitoring. Programs that emphasize the structure of language and whole-word reading using semantic or syntactic clues are recommended. Research also tells us that older students require more time for remediation; Steven should be spending at least an hour per day receiving explicit, systematic intervention.

2. While Steven builds his basic reading skills, he needs to access grade-level content through the use of reading materials at his independent reading level. Content-specific vocabulary should be taught explicitly in such a way that he is able to recognize and spell the new word as well as understand its meaning. This can be approached visually through the use of color-coding, the identification of patterns within words, and morphology.

3. Steven would benefit from re-reading text to improve understanding. Initially, reading assignments may need to be shortened to allow time to re-read as he becomes aware of the benefits.

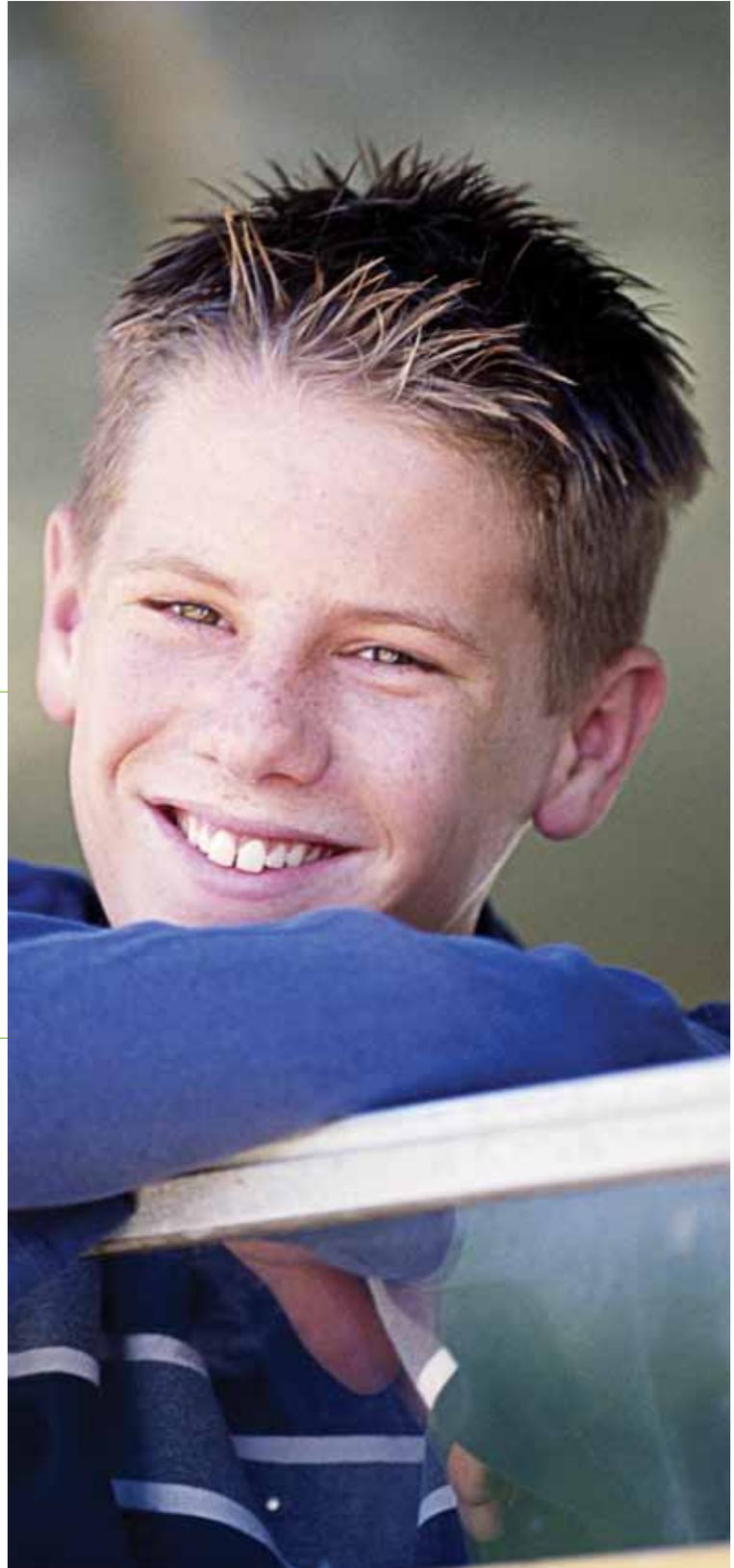
4. It is important to reduce working memory demands when new learning is taking place and information is not yet automatized. One way to do this is to help Steven learn how to create graphic organizers to enhance reading comprehension and writing exercises. This approach, which is based on Steven's visual processing strengths, supports planning prior

to composing. It also supports the identification of the main idea and specific details when reading.

5. Steven would benefit from explicit and intensive metamemory strategy training. He needs to understand his own memory strengths and weaknesses and develop rote strategies, visual imagery, use of mnemonics, rehearsal strategies, and encoding strategies.



Steven has the intellectual capacity
to function well in school
despite his learning disabilities.



800.627.7271 |  PsychCorp | PsychCorp.com

Copyright © 2011 Pearson Education, Inc. or its affiliate(s). All rights reserved. WISC, Wechsler Intelligence Scale for Children, ERSI, and Early Reading Success Indicator, Wechsler Individual Achievement Test, WIAT, Pearson, design for Psi, and PsychCorp are trademarks in the U.S. and/or other countries, of Pearson Education, Inc. or its affiliate(s). 4715 03/11 F0720C3