
Cognitive Deficits

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Long Term Retrieval

Assessment Measures

Long term retrieval measures proficiency in storing and retrieving information over periods of time. It involves the ability to learn by making associations.

The following tests of the WJ-R measure long term retrieval:

Memory for Names [test 1]

This test measures the student's ability to make auditory-visual associations between pairs of unfamiliar stimuli (auditory-visual association).

Visual-Auditory Learning [test 8]

This test measures the student's ability to make visual-auditory associations by pairing visual symbols with familiar words (visual-auditory association).

No subtests of the WAIS-R isolate long term retrieval. The information subtest measures associative memory which is content/culture based and is broader than long term retrieval.

Functional Manifestations

If a student demonstrates a deficit in long term retrieval, she/he may have difficulty with tasks that require use of information that has been learned previously. For example, in reading, the student may have trouble remembering the sounds made by letters; in spelling, the student may be unable to remember or apply spelling rules; and in math, the student may have difficulty memorizing the times tables.

Deficits in memory are usually related to the type of memory process involved. The two major types of memory processes are auditory-verbal memory and visual memory. Students may have problems with one or both of these processes.

Long Term Auditory Verbal Memory

A student with a deficit in auditory-verbal long term memory may have difficulty remembering information learned in words: e.g., instructions, lectures and/or reading. Information of particular difficulty may include lists of facts and rules such as those in grammar, spelling, chemistry, physics and biology.

Functional Manifestations
(cont.)

In daily life these students may have problems remembering schedules or appointments, instructions from parents, and instructions from physicians or other professionals. They may also forget when prescriptions need to be refilled or how a joke was told.

Long Term Visual Memory

A student with long term visual memory deficits may have difficulty with mathematical tables, geometric figures and/or algebraic formulas. Spelling may be difficult if the student spells primarily by remembering the shape of a word rather than its sound. In addition, this student may have difficulty memorizing geographical information, charts and graphs, schematics, sign languages, and movement sequences (e.g. dance and martial arts).

In daily life this student may have difficulty remembering landmarks and therefore easily become lost. The student may have difficulty remembering information from maps unless translated into verbal directions, and may also have difficulty following directions for construction or repair of items if these directions are based upon schematic drawings.

Software Considerations

Instructional Goal

Students will apply memory strategies in a variety of contexts to improve information storage and delayed information retrieval.

Instructional Considerations

It is likely that memory will *not* improve solely on the basis of software work. Memory scores may improve if the student is made familiar with a number of strategies which will assist in information storage and retrieval. Examples of memory strategies are: picturing, personalizing and organizing material. Most software programs do not teach specific memory strategies, but instead provide a forum for practicing learned strategies. The instructor should make clear how the memory strategies being practiced can apply to everyday life.

Software Characteristics

Feedback should be educational.

Frequent on screen scoring allows students to learn from their responses. There should be an opportunity to try a task more than once with minimal penalty. Cues should be provided if responses are repeatedly inaccurate. Students should be able to determine their most effective learning modality by comparing scores on a variety of tasks. The software should accept close approximations of spelling where accuracy is not essential.

Software tasks must provide practice with a limited number of easily defined strategies.

Practice with a limited number of strategies enables a student with memory problems to clearly understand the nature of the strategies being developed and used.

Tasks should be presented in order of increasing complexity.

It is critical for students with memory problems to begin developing memory strategies at a simple level before moving to more complex levels. Tasks of increasing complexity provide motivation and an opportunity to self-monitor for effective application of the strategy being practiced. In this way mastery of a particular memory strategy may be achieved.

Format should be motivating.

Memorization can be boring. Computer graphics, auditory and visual reinforcers, or a game format provide motivation for continued practice.

Reading and spelling tasks should be matched to the student's abilities.

Students should be able to attribute their scores to memory practice only. Errors in reading or spelling confuse and frustrate students and are unrelated to the memory task itself.

Software Considerations
(cont.)

An authoring component should be available when appropriate.

Authoring components which allow students to develop visual memory aids (e.g., flash cards, lists, outlines for academic coursework) are particularly useful. Learning has a greater chance of occurring when activities can be applied in real life situations.

Potential for distraction from the task should be provided.

Distraction is a primary hindrance to the ability to memorize successfully. Software-generated distractions provide the opportunity for students to learn how to overcome this problem.

Suggested Software

Memory Castle (Sunburst/Wings for Learning) - DOS

Students play a fantasy game requiring sequential memorization of instructions. This software is particularly good for practicing the following memory strategies: visualization, mnemonic systems, and personalization. Tasks of increasing complexity are presented and the format is motivating.

Memory Building Blocks (Sunburst/Wings for Learning) - DOS/MAC

This program builds visual and auditory memory. Students practice memory strategies to recall tunes, words, shapes, patterns and objects. The software is educational and relevant to memory class curriculum. Tasks of increasing complexity are presented and format is motivating. Authoring and potential for distraction are provided.

Foundations II Memory (Psychological Software) - DOS

A variety of learning tasks are presented. Students must practice memory strategies for visualization and information organization. The software is relevant to memory class curriculum. Tasks of increasing complexity are presented, and potential for distraction is provided.

Cognitive Rehabilitation: Memory (Hartley) DOS

This program presents a simple format for practicing recall of increasingly complex verbal tasks. The program's capacity to present distracters for tasks is a special strength. Authoring is also available.

Word Attack Plus!, Spell it Plus!, Math Blaster Plus! (Davidson) - DOS/MAC

These programs are useful for memorization of basic academic material such as vocabulary and mathematical operations. The software is educational and motivating. An authoring component is provided which allows for input of student coursework.

Short Term Memory

Assessment Measures

Short term memory involves comprehension and use of information within a short period of time. It is often called working memory.

The following tests of the WJ-R measure short term memory:

Memory for Sentences [test 2]

This test measures the student's ability to recall sentences subsequent to auditory presentation.

Memory for Words [test 9]

This test measures the student's ability to recite lists of unrelated words in exact sequence.

The following subtest of the WAIS-R measures short term memory:

Digit Span [subtest 3]

This subtest measures the student's ability to recall sequences of numbers presented auditorily.

Functional Manifestations

A student with a deficit in short term memory (active working memory) will have difficulty holding on to information for a long enough time to manipulate it mentally. Thus, she/he may be unable to relate it to other information in an on-going situation. An example of this deficit might be the following: during a lecture, when an instructor states a key principle and then proceeds to give an illustrative example, the student with a short term memory deficit may lose track of the principle while listening to the example. The same thing may happen for students when reading, doing mathematical calculations, or following directions.

Software Considerations

Instructional Goal

Students will apply strategies for recalling and using information within a brief span of time.

Instructional Considerations

Deficits of short term memory may be, in fact, deficits of what is commonly called “focus.” Students must be aware of whether or not they are attending to the task. (i.e. “Am I here?”) This concept of short term memory incorporates “active working memory” which, as defined by Sohlberg and Mateer, is that form of memory at work “when there is some requirement to analyze or mentally manipulate the material” and where, “no permanent storage is postulated” (p. 137).

Software Characteristics

Format should be motivating.

The task of this software is to train students to attend to multiple stimuli and/or stimuli which increases in complexity and length. Because this type of memory practice can be boring, it is important that software provide visual or auditory reinforcement to motivate students to continue practicing. Game formats are often the most successful in generating motivation, but the student must be taught to apply the skills she/he is learning to every day activities in and out of school.

Software should require mastery before student can advance to a higher level.

Confusion and frustration will result if a student advances before she/he has mastered the current memorization task. Often the instructor must monitor students to be sure that this software is being used properly.

Software should provide a variety of activities.

By working in a variety of activities, a student can monitor the ways in which her/his mind functions in the context of these different activities. More importantly, these activities provide the student with experiences which reveal how her/his particular mind works. Some tasks will be easier than others depending upon the individual student. Software scores can be used as tools to illustrate a student’s learning strengths and weaknesses.

Software Considerations
(cont.)

Software should provide frequent feedback.

Short segments with feedback provided allow the student to take in the information they are learning about themselves more effectively. If a task is too long or complex this benefit will be compromised by frustration due to repeated errors.

Reading and spelling tasks should be matched to the student's abilities.

Students should be able to attribute their scores to memory practice alone. Errors in reading or spelling contaminate information the student needs to learn about efforts to improve short term memory.

Suggested Software

Captains Log: Attention Skills & Visual Motor Skills Modules (Brain Train) - DOS

This program's clear graphics and design make it adaptable for teaching a variety of attention and memory skills. Format is motivating, a variety of activities are presented, and frequent feedback is provided. This program is not reading- or spelling-based.

Memory Building Blocks (Sunburst/Wings for Learning) - DOS/MAC

This program provides exercises which illustrate the relationship between attention and memory. This software provides motivating format, a variety of activities, and frequent feedback. Minimal spelling skills are required.

Foundations II Memory (Psychological Software) - DOS

This program provides students with practice in a variety of exercises which are designed to increase attention span. The activities are especially designed to generate minimal frustration. Additionally, the software provides a motivating format, a variety of activities, and frequent feedback, and is not reading- or spelling-based.

Processing Speed

Assessment Measures

Processing speed measures the ability to perform simple, relatively automatic, visual-motor tasks and maintain attention under timed conditions.

The following tests of the WJ-R measure processing speed:

Visual Matching [test 3]

This test measures the student's ability to demonstrate visual discrimination by circling pairs of identical numbers in a series under timed conditions.

Cross Out [test 10]

This test measures the student's ability to make quick comparisons of visual symbols.

The following subtest of the WAIS-R measures processing speed:

Digit Symbol [subtest 10]

This subtest measures the student's ability to reproduce symbols associated with numerals under timed conditions.

Functional Manifestations

A student whose test behavior suggests specific processing speed deficits may have difficulty understanding lengthy directions or lectures, completing reading or written assignments in a timely fashion, and completing any tests or assignments under timed conditions, especially those involving extensive retrieval or organization of information. Unless concentration and memory skills are particularly strong, processing speed deficits may also impact negatively on other academic skills which exceed this student's duration of concentration and memory capabilities, e.g., algebraic calculations, computer programming and even tests or assignments which are not timed.

In daily life, depending on the severity of the processing speed deficit, there may be problems in taking phone messages, understanding news on the radio, driving skills and any tasks involving rapid hand-eye coordination (e.g. sports, video games).

It may be necessary to use compensatory strategies (e.g. audio taping for note taking) for functional academic purposes.

**Software
Considerations**

Instructional Goal

Students will increase comprehension speed and reaction time while responding to a variety of information.

Instructional Considerations

It is imperative that students enjoy and see the purpose of, tasks developed to improve processing speed. Additionally, although students may want to advance to higher levels of difficulty before they are ready, it is important that they remain at baseline levels until they achieve “automaticity.” It is especially important for an instructor to monitor students working on this type of task.

Software Characteristics

A wide range of speed levels should be available so that students can work on content at or near ability levels.

Software for processing speed should offer a wide range of speed levels in order to allow success for slower students and challenges for higher functioning students. Content difficulty should be within or near students’ abilities so the task focus is primarily on increasing the speed of accurate responses (and not on error responses which result from poor reading skills). Software with an open-entry structure for task selection allows students to begin at or near the speed level they find challenging.

Response process should reflect rapid processing of information.

The response process should reflect that the student has processed the information, and processed it accurately. Students should not be penalized for a slow keyboard entry rate. If the software objective is reading more quickly, speed and accuracy of the response (e.g., keyboard entry of word(s) that were read) should not be an issue.

Software should include a timing component.

A timing component should monitor students’ speed of task completion and/or challenge them to work faster. It can do this in at least four ways:

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- presenting visual stimuli for a set duration;
 - discontinuing tasks when a set duration for responding has been exceeded;
 - documenting response time as feedback; or
 - providing a “chase” environment to motivate the student to complete the task before negative consequences occur.

**Suggested
Software**

Speed Reader (Davidson) - DOS/MAC

The warm-up portions (letters or words) of this program are particularly useful because speed of presentation automatically increases following accurate responses and decreases following inaccurate responses. A wide variety of reading levels is available.

Tetris/Welltris (Spectrum Holobyte) - DOS

These programs are particularly useful in motivating students to (1) rapidly process visual information and (2) plan reactions to material which increases in speed. Initial speed levels can be selected so that students can begin at their own levels.

NumberMunchers (MECC) - DOS/MAC

This program is particularly effective in speeding the processing of basic mathematical information. It is not difficult to select content or control the level of difficulty. The response mode is simple and incorporates good feedback.

WordMunchers (MECC) - DOS/MAC

This program is particularly useful in speeding processing of phonetic decoding of vowels. It is easy to select target vowel sounds and word difficulty. As above, the response mode is simple and incorporates good feedback.

Visual Processing/ Perceptual Organization

Assessment Measures

Visual processing/perceptual organization measures visual perception of patterns, spatial relations, and attention to visual details.

The following tests of the WJ-R measure visual processing/perceptual organization:

Visual Closure [test 5]

This test measures the student's ability to identify objects from pictures that are presented with missing parts, distortions, or superimposed patterns.

Picture Recognition [test 12]

This test measures the student's ability to use immediate recall to recognize a previously presented object from among a group of similar objects.

The following subtests of the WAIS-R measure visual processing/perceptual organization:

Picture Completion [subtest 2]

This subtest measures the student's ability to recognize important missing visual details from pictures.

Block Design [subtest 6]

This subtest measures the student's ability to manipulate blocks to reproduce a visually presented pattern under timed conditions.

Object Assembly [subtest 8]

This subtest measures the student's ability to manipulate puzzle parts and synthesize them into a unified whole under timed conditions without a visual stimulus.

Functional Manifestations

A student with a deficit in visual processing/perceptual organization may have difficulty with reading, writing, and mathematics due to inaccurate processing of the shapes of letters and numbers. Such a student may also have difficulty with geometry or with reading and constructing graphs, charts, diagrams, maps and tables.

In daily life these students may have difficulty in activities which rely heavily on visual processing: e.g., using reference materials such as the yellow pages in a phone book. It is probable that they will not enjoy putting together models or puzzles, following patterns, or doing art projects which require visual-spatial awareness and ability.

Software Considerations

Instructional Goals

Practice strategies to improve organization of visual data leading to a product.

Practice strategies to improve discrimination of increasingly subtle variations in visual sequences, spatial relationships among objects, and orientation of objects.

Instructional Considerations

Software provides the opportunity for improvement of visual perceptual skills as well as cognitive mediation of (thinking about) visual perceptual tasks when the solution is not readily perceived.

These software goals combine strengthening visual perceptual skills and thoughtful, efficient problem solving.

When concentrating on academic tasks (e.g. writing using a word processor) students can take advantage of strategies to compensate for visual perceptual weaknesses. These strategies include adjusting screen colors, adjusting text font, adjusting text size, adjusting format of work on the monitor, enlarging the cursor, using copy holders with line guides, and using on-line reference and personal management tools.

Software Considerations
(cont.)

Software Characteristics

The software text and graphics must be easily perceived.

The monitor must have clear resolution (e.g. smooth characters, no bleeding colors, no bouncing graphics, no obvious flicker) so the quality of the images will not interfere with perception of the material.

There should be clear, minimal on-screen directions.

Students should not be distracted from visual perceptual tasks by confusing or difficult to read directions.

The software should provide carefully sequenced activities.

It is especially important that software activities be sequenced to help students avoid sensory overload and confusion, maintain their motivation, and provide enough challenges to stretch their skills.

Responses should reflect decisions regarding organization or discrimination of visual perceptual data.

Success with the software must depend on using visual perceptual skills.

Suggested Software

Factory (Sunburst/Wings for Learning) - DOS/MAC

This program is especially useful because of its clear, brief instructions written at a low reading level. Additionally, it provides opportunity for unlimited practice with exploratory activities before beginning Factory games. It provides user-control over choice and complexity of activities chosen. The documentation includes worksheets which clarify and facilitate the tasks. Supplementary worksheets offer additional activities.

Print Shop and Print Shop Deluxe (Broderbund) - DOS/MAC/WINDOWS

These programs are useful because they provide students with the opportunity to exercise visual perceptual skills in

preparing a usable product (greeting card, sign, banner, stationery, calendar). While working to complete their projects, students have many experiences exploring, choosing, evaluating and editing the relationships among visual design elements. Because of its consistent format and layout, this program also reinforces generalization skills.

The Super Factory (Sunburst/Wings for Learning) - DOS

This software allows the student to develop and practice strategies for 3-dimensional manipulation of a cube. Although some students may initially need additional support from the instructor in order to understand the task, the graphics and on-screen controls are clear. The student has the option of controlling the block manipulation process; this is useful when a student is first learning to use the program. Later, this option can be used as a strategy development tool.

The Right Turn (Sunburst/Wings for Learning) - DOS

This software allows the student to develop and practice strategies for visual manipulation of a 3X3 grid. Graphics and instructions are basic and clear.

Comprehension-Knowledge/ Verbal Comprehension/ Expression

Assessment Measures

Comprehension-knowledge/verbal comprehension measures expressive language ability based on the breadth and depth of cultural knowledge and experience. It includes not only the comprehension of communication but also the types of reasoning based on previously learned operations.

The following tests of the WJ-R measure comprehension-knowledge/verbal comprehension:

❑ *Picture Vocabulary [test 6]*

This test measures the student's ability to identify pictured objects.

❑ *Oral Vocabulary [test 13]*

This test measures the student's ability to provide synonyms and antonyms for a list of presented words.

❑ *Listening Comprehension [test 20]*

This test measures the student's ability to understand vocabulary, meaning, levels of construction, and use of word forms with items presented from audio tape. Although this test was not included in the LD Model Development Study, it is valuable because it measures all levels of language processing from basic auditory processing to a complex grasp of syntax and semantics.

The following subtests of the WAIS-R measure comprehension-knowledge/verbal comprehension:

❑ *Information [subtest 1]*

This subtest measures the student's ability to provide verbal responses to questions of general knowledge.

❑ *Vocabulary [subtest 5]*

This subtest measures the student's ability to provide concise definitions for a list of presented words.

❑ *Comprehension [subtest 9]*

This subtest measures the student's ability to respond to oral questions pertaining to everyday social situations and cause and effect relationships.

❑ *Similarities [subtest 11]*

This subtest measures the student's ability to utilize abstract verbal reasoning to identify the general classification for pairs of related items.

❑ *Picture Arrangement [subtest 4]*

This subtest measures the student's ability to put in meaningful sequential order a series of picture story cards by using visual context clues.

Note:

Because this area of assessment is so broad, descriptions of functional behaviors and software considerations are broken down into two basic areas,

1. Vocabulary, and
2. Verbal (listening) comprehension

**Functional
Manifestations
Vocabulary**

Students with vocabulary deficits will have difficulty understanding lectures or complicated verbal directions because they do not remember what certain words mean. Vocabulary deficits are particularly problematic for students if no visual information is provided to support the material. Difficulties will also be noticed in reading comprehension, although they may be less severe in this context because words remain on a page and contextual analysis can occur.

**Software
Considerations
Vocabulary**

Instructional Goal

Students will increase written vocabulary at the single word level and categorize relationships among words.

Instructional Considerations

It should be noted that tests used to measure these skills require a verbal/oral response, while most computer software requires a written or motor response.

Software Characteristics

Objectives and content should be clearly organized.

Objectives for the development of vocabulary and word relationships should be functional and clearly stated. Whether by grade-level, by part of speech, or as survival vocabulary, its organization should be in agreement with the instructional objectives for these students.

Definitions should be clear and within students' reading abilities.

Content for vocabulary/word relationship tasks should offer a wide range of reading/spelling levels with instructions and definitions clearly within students' reading levels. The content of definitions is easily susceptible to cultural biases and should be reviewed with students. It is suggested that new word lists be limited to no more than 20 per set. After mastery of each set, some integration of word sets may be helpful in generalization. An open-entry process allows students to begin at or near a challenging level.

Format should be interactive, with a variety of drill activities available.

Format is crucial in vocabulary development. An interactive instructional format for initial learning of new vocabulary or word relationships (as opposed to the display-only format of many programs) is beneficial prior to drill formats. A variety of activities (e.g. multiple choice, matching, sentence completion) not only accommodates

different learning styles, but also facilitates generalization of word knowledge. Because many programs are drill-based, a motivating format assisted by appropriate graphics, is helpful.

Response processes should reflect knowledge of word meanings or relationships.

Opportunities for choice responses and single word entry responses should be available, but unless instructional objectives stress accurate spelling, the program should provide some assistance and/or accept a range of spelling accuracy in responses. When responses are inaccurate, the correct answer should be displayed.

Authoring component should be easy to use.

Entry of material relevant to students' current needs is the most functional use of these programs.

Spoken output is desirable.

The dual input of visual and spoken word production not only accommodates both auditory and verbal learners, it also assists in generalization of new vocabulary into spoken language.

**Suggested
Software
Vocabulary**

Word Attack Plus (Davidson) - DOS/MAC

This program, which now includes spoken production of its vocabulary, has an array of formats, is organized by grade level and part of speech, and has an authoring capability.

Spell-It Plus (Davidson) - DOS/MAC

This program is useful because of its array of formats, its organization by spelling rules, and its authoring capability.

Cognitive Rehabilitation (Hartley) - DOS

The Association, Categorization, and Sequencing programs in this series are particularly useful in their development of word relationships, and in their authoring capabilities.

**Suggested
Software
Vocabulary
(cont.)**

Synonyms/Antonyms/Analogies (Hartley) - DOS

These programs are particularly useful in their development of more complex word relationships, and their authoring capabilities.

**Functional
Manifestations
Verbal (Listening)
Comprehension**

A student with verbal comprehension deficits will have difficulty understanding verbal information when listening. Verbal comprehension deficits can interfere with student success when it is necessary to listen to lectures, verbal directions or social conversations. These deficits may be due to poor vocabulary, inability to understand complex grammatical structures or limited background experience. Short term memory deficits may also limit verbal comprehension. If the student is unable to hold multiple chunks of information in memory long enough to relate them to new information being received, then that student will not understand the concept being discussed. Therefore, student questions and comments may not be to the point or may show evidence of wrong assumptions.

**Software
Considerations
Verbal (Listening)
Comprehension**

Instructional Goal

Students will demonstrate comprehension of increasingly complex verbal language concepts. Materials need to increase in length and complexity from single word to extended paragraph.

Instructional Considerations

Currently, there is no commercially available computer-assisted instruction that addresses verbal comprehension in the context of understanding what people say (i.e. lectures, directions, conversations).

Some software in CD-ROM format provides activities which combine a visual and auditory stimulus of words as text is being read.

Skills may need to be addressed through reading rather than auditory comprehension. Having students read information aloud in small groups will translate reading tasks into auditory-verbal comprehension tasks. As content increases in

length, students will need to utilize strategies to assist short and long-term memory in order to organize and retain information.

Software Characteristics

Software content should reflect differing levels and types of complexity.

Material can increase in difficulty in many ways: in length, in grammatical complexity, and in the abstractness of its ideas. The software should effectively organize difficulty levels acknowledging these parameters.

Software content should be free from cultural bias.

Because grammatical structures and abstract ideas are easily susceptible to cultural biases, content should be reviewed with students before use.

Response processes should reflect comprehension.

If keyboard entry is required for response, students should not be penalize for spelling errors.

Feedback should be educational.

Opportunity for repeated attempts at correct answers is important in this area, as is identification and explanation of accurate responses. Ideally, material relevant to the correct answer should be highlighted (perhaps as cues), and there should be feedback to explain why inaccurate responses are in error.

Content should require association of ideas.

Tasks should require students to determine main ideas, make inference, and/or draw conclusions.

Program content should be suitable for class discussion on the use of strategies for organization of material.

Extended verbal information needs to be organized in order to facilitate comprehension and retention. Strategies for organizing the material received can be reviewed before the task, as part of the task, and/or after the task.

**Suggested
Software
Verbal (Listening)
Comprehension**

Ace Series - Mindplay - DOS

This series is particularly useful because of the organization and design of each program. Each program focuses on one concept (identifying main idea and facts, sequencing events, drawing conclusions, and separating fact from opinion). Each program also requires students to separate pertinent from non-essential information, and has a motivating format. These programs are useful for small group activities.

Carmen San Diego Series (Broderbund) - DOS/MAC

These programs are particularly effective in facilitating generalization of vocabulary development, forcing students to make abstractions from prior knowledge bases, and in facilitating students' development of organizational strategies. Additionally, the game format is motivating. The programs also facilitate collaborative learning because they can be used in small group settings.

Decisions, Decisions - Tom Snyder - DOS/MAC

This software requires theme analysis and is particularly good for team play and reading aloud. It may be used to teach students how to organize and evaluate advice. This software requires teacher facilitation.

**Tell-Tale Heart - Discis Books - CD-ROM for DOS/
WINDOWS/MAC**

This disk-based version of the Poe classic comes with extensive auditory material: pronunciation of words, syllabication, definitions, and parts of speech for words. It also provides an option for having the story read from two different perspectives and an option to place comprehension questions opposite the page currently being read. Some comprehension questions are accompanied by an auditory answer which can serve as a verbal model for students.

Fluid and Abstract Reasoning

Assessment Measures

Fluid reasoning measures the student's ability to draw inferences and make applications from controlled learning tasks. It represents the highest level of reasoning skills involving inferential and qualitative thinking.

The following tests of the WJ-R measure fluid reasoning:

❑ *Analysis/Synthesis [test 7]*

This test measures the student's ability to use learning, reasoning, and generalizing skills in solving logic puzzles.

❑ *Concept Formation [test 14]*

This test measures the student's ability to utilize nonverbal problem solving strategies and categorical reasoning.

The following subtests of the WAIS-R measure abstract reasoning:

❑ *Arithmetic [subtest 7]*

This subtest measures the student's ability to use mathematical reasoning to solve math word problems mentally.

❑ *Similarities [subtest 11]*

This subtest measures the student's ability to utilize abstract verbal reasoning to identify the general classification for pairs of related items.

Functional Manifestations

A student with deficits in the areas of fluid and abstract reasoning may have difficulty organizing and classifying ideas or seeing implications for the broader application of learned rules. For example, this student may memorize the steps of meiotic cell division in basic biology but may not see how that knowledge applies to understanding the transmission of genetic traits to one's own offspring. The same deficit would make it difficult to understand symbolic representations, interpret characterization in literature, or apply principles learned in sociology or anthropology to daily life. Such students may also have difficulty seeing relationships which govern sequencing tasks, especially when multiple associations are involved or may find it difficult to solve problems which require two or more steps to solution.

Software Considerations**Instructional Goal**

Students will practice the skills of inference, sequence, logic, rule-formation (classification), and organization of complex information leading to improved problem-solving skills. Students will learn to evaluate results and develop new solutions as necessary.

Instructional Considerations

Improvements in abstract reasoning require a combination of teacher support and independent student work on software. Teacher support might take the form of organizing students into teams, providing focus for an activity, or demonstrating organizational strategies.

It is essential that students be made aware of the types of reasoning and organization options appropriate to the problems that they are solving. Examples of problem-solving strategies are working backwards, making a prioritized list, stating the problem as a question, and developing a table or chart.

Students with language-based learning disabilities often discover that visual-spatial software programs like Factory and Safari Search are easier for them than are more verbally “loaded” programs such as the Carmen Sandiego series. Such a realization may help a student understand more clearly the nature of his/her disability.

Software Characteristics

Software should have clear instructions.

Although it may seem redundant to list this elementary software attribute, clarity of instructions is of paramount importance for students with reasoning problems. Additionally, the goal(s) of the program must also be clearly stated.

Software scores should be clear and accessible.

Students will often stray off task with complicated or lengthy programs. Therefore, interim scores or scoring in short segments allows them to correct for errors and have more success in finding solutions.

Software should have a motivating format.

Appropriate feedback will encourage students to continue working on tasks. Age-appropriate and/or contemporary themes are essential to full student participation.

Software should encourage teamwork.

Many students learn best when teaching someone else. Software which permits students to work in teams generates a good learning environment. Team members learn from one another and new solutions emerge from the group which might not have been obvious to an individual working alone.

Success with software requires organization of information.

A primary purpose of this type of software is to teach inference and complex problem solving. Success should require the student to develop and employ a variety of information management strategies. Examples of information management strategies are note taking in the form of a list, table, chart, or solution matrix.

Success with software should require analysis of information.

Students should not be able to “win” by guessing or by trial and error. They should understand exactly how they arrived at a conclusion and why the conclusion is the correct one.

**Suggested
Software**

**Where in the World is Carmen San Diego? (Broderbund) - DOS/
MAC**

This software provides clear instructions and scoring, has a motivating format, and encourages team play. It also requires organization and analysis of information.

Safari Search (Sunburst/Wings for Learning) - MAC

This software stimulates non-verbal abstract reasoning. It is particularly good at helping students learn to differentiate between inference and guessing. It provides clear instructions and scoring, has a motivating format, and encourages team play. It requires organization and analysis of information.

**Suggested
Software
(cont.)**

Factory (Sunburst/Wings for Learning) - DOS/MAC

This software stimulates non-verbal reasoning. It is also effective in teaching sequential reasoning in the visual mode. Factory provides clear instruction and scoring, has a motivating format, and encourages team play. It requires organization and analysis of information.

Decisions Decisions: Television (Tom Snyder) - DOS/MAC

This software requires theme analysis and is particularly good for team play. It may be used to teach students how to organize and evaluate advice. This software requires instructor-facilitation.

Lost Tribe (Lawrance Productions/Davidson) - DOS/MAC

This program is useful in providing a high interest format for making decisions, solving problems or estimating needs, and testing hypotheses. Students need to use reading skills as well as knowledge of mathematics, time, and human nature in order to be successful in this game / adventure format.

Freedom From Distractibility

Assessment Measures

Freedom from distractibility measures the ability to focus attention, concentrate, and resist distraction.

None of the tests of the WJ-R are specifically designed to measure freedom from distractibility; however, the examiner may use behavioral observations.

The following subtests of the WAIS-R measure freedom from distractibility:

❑ *Digit Span [subtest 3]*

This subtest measures the student's ability to recall sequences of numbers presented auditorily.

❑ *Arithmetic [subtest 7]*

This subtest measures the student's ability to use mathematical reasoning to solve math word problems mentally under timed conditions.

Functional Manifestations

This student may have difficulty focusing attention on a task when mental or physical distractions are present. Such students will find it very difficult to work if they are preoccupied with their thoughts or if there is something going on in their environment which competes for their attention. This behavior may be accompanied by hyperactivity although it is not always the case.

In school these students have difficulty attending to a lecture where there are environmental distractions. Participating in a laboratory situation where many things are happening at the same time may be difficult. They may also find it difficult to apply themselves to school work for a long enough period of time to complete assignments well.

In daily life these students may often be late and seem to be disorganized, inconsistent or unreliable. They may become very frustrated and tired due to the effort required to focus their attention.

Software Considerations**Instructional Goal**

Students will increase sustained mental focus to a stimulus or series of stimuli, and increase the duration of that mental focus.

Instructional Considerations

When working to remediate this area, instructors may need to consider ways of initially isolating the student from outside distractions, e.g., facing students away from movement or activity.

Some students may benefit from listening to soft music from “Walkman”-style headphones. Techniques to insulate students from distractions should be gradually removed before increasing difficulty levels in software programs.

These techniques can also be considered when compensating for distractibility while working in other types of software programs.

Software Characteristics

Content difficulty should not interfere with task objectives.

For freedom from distractibility, it is important that content difficulty be at a level where students are currently successful. In this way students are not bored by easy content and can focus on inhibiting reactions to extraneous events, rather than on difficult content.

Parameters for duration of focus should be controllable.

Task duration should be set to appropriate levels for each student, or the task process should be designed so that it ends when the student is distracted.

Distraction from the task should be detrimental to students’ score or negatively impact their performance on the task.

The motivation or “challenge” to students is usually to maximize performance on a task with content they perceive as within their grasp. In these cases the negative impact of

their distractibility serves to motivate them to focus more consistently. These students are often motivated to improve their scores if an onscreen display of best scores is included with the program.

**Suggested
Software**

NumberMunchers (MECC) - DOS/MAC

This program is particularly useful in motivating students to focus on the basic mathematical problems. It is necessary to solve problems in order to avoid being devoured by small creatures. Content and level of difficulty are easily controlled.

WordMunchers (MECC) - DOS/MAC

This program is particularly useful in motivating students to focus on the words being decoded (in order to avoid being devoured by creatures). Vowel sounds selected and word difficulty are easily controlled.

Tetris/Welltris (Spectrum Holobyte) - DOS/MAC

These programs are particularly useful in motivating students to focus on the visual stimuli.

Foundations II (Psychological Software) - DOS

Most of the subtests of this program have deterrents for distraction in timing or in task accuracy.

Captain's Log (Brain Train) - DOS

The Attention Module and Visual-Motor Module of this program are particularly useful in motivating students to focus on the visual stimuli.

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