Why Students Struggle to Learn: An Overview of Cognitive Factors

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Joe

- Grade 1
- Unable to name words accurately
- Psycho-educational Evaluation
  - Average ability
  - Average achievement in math and written language.
  - Significant discrepancy between ability and achievement in (1) basic reading and (2) reading comprehension
  - Classified SLD in reading
Objectives

- Describe learning as a multi-factorial process.
- Describe cognitive factors involved in students’ acquisition of skills and concepts.
- Discuss how a weakness in cognitive processes can affect learning.
Learning and Cognitive Factors
The Process of Learning

- Learning is the process of acquiring information.

- What are the cognitive factors that enable students to show what they know and can do?
  - How do they collect, sort, store, and retrieve information? (Miller, 2007)
  - How do they receive, perceive, process, and remember information? (Elliott, 2007)
Learning - A Multi-Factorial Process (Miller, 2007)

Social-Emotional, Cultural, Environmental, and Situational Factors

Overall Cognitive Functioning and Academic Achievement

Speed and Efficiency of Cognitive Processing

Executive Functions

Memory and Learning Processes

Visual-Spatial Processes

Language Processes

Sensory-Motor Functions

Attentional Processes
Figure 2.5 Narrow and Broad Factors in Cattell-Horn-Carroll Theory

Gc: Crystallized Intelligence
Gf: Fluid Intelligence
Gv: Visual-Spatial Processing
Gsm: Short-Term Memory
Gl: Long-Term Storage and Retrieval
Gs: Cognitive Processing Speed
Ga: Auditory Processing
Sensory-Motor Functions and Learning

To respond effectively to the demands of the typical classroom, children must be able to encode information, and show what they know.

- Is the child able to see the information? Is visual acuity within normal limits?
- Is the child able to hear the information? Is hearing acuity within normal limits?
- Is the child able to respond in writing? Are fine motor abilities within normal limits?
- Is the child able to respond orally? Are language production abilities within normal limits?
Attention and Learning

To receive, perceive, process, and remember information, children must

- selectively attend to certain stimuli while ignoring competing, irrelevant stimuli.
- sustain attentional focus for a prolonged period.
- shift attentional resources from one activity to another.
- respond to more than one task simultaneously - divided attention.
Visual-Spatial Processes and Learning

- Much of what is presented in school has either a visual-spatial or language basis.
- Visual-perceptual skills play a major role in the development of a child’s handwriting skills, and fluency in math and reading.
- For example, a student may be able to name individual letters in a word (visual analysis, b-e-d). She may be unable to integrate the letters to say the word (visual synthesis, bed).
Language and Learning

Language is the basis for much of the learning that occurs in schools.

- Children must understand words and sentences to perceive and process information - receptive.
- They must use words to show they can retrieve information from memory - expressive.
- Early development of reading depends critically on whether the receptive phonological component of the aural system and the expressive phonological component of the oral system are developing in an age-appropriate manner (Berninger, V., 2007).
Memory and Learning

- Learning - process of acquiring new information.

- Memory - persistence of learning in a state that can be revealed at a later time” (Squire, 1987).

- In schools, we expect children to learn and remember information. Often, the information is presented verbally and/or visually.
## Process of Learning and Remembering

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Encoding</strong></td>
<td>External information is transformed into mental representations or memories and stored in STM.</td>
</tr>
<tr>
<td><strong>Consolidation</strong></td>
<td>Information from immediate memory is solidified into long-term memory stores.</td>
</tr>
<tr>
<td><strong>Retrieval</strong></td>
<td>Information is brought into conscious awareness.</td>
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Executive Functions

- Mental functions associated with ability to engage in behaviors that are:
  - Purposeful
  - Organized
  - Self-regulated
  - Goal-directed

- Internal supervisory guide for learning and performance in the classroom.
Executive Functions and Attention

Executive functions interact with, direct and modulate attentional processes including:

- Sustaining optimal levels of arousal and vigilance
- Searching for, selecting, and attending to relevant information from a broad array of stimuli

Individuals who perform poorly on executive function tasks may have deficits in attention, executive function, or both.
Executive Functioning and Working Memory

- Many executive function tasks also require working memory—actively holding information in memory during cognitive tasks.

- Children with poor working memory may lose the “thread” and forget parts of the instruction, or even their own intention in the face of competing stimuli.
Attention and Executive Functioning

- Related to memory and learning.
- Often, memory problems are secondary to deficits in Attention and Executive Functioning, Language and Visuospatial Processing.
- Primary memory problems impact a child’s ability to learn and to be effective in school and everyday life.
Speed of Processing and Learning

• Efficient cognitive processing frees-up cognitive resources for more complex or higher-level tasks.

• A weakness in the speed of processing routine information may make the task of comprehending novel and/or non-routine information more time-consuming and difficult.

• For example,
  - If a child names words effortlessly, s/he can focus cognitive energy on higher-order comprehension.
  - If a child computes fluently, s/he can focus on application.
Applying Concepts to School
A Reading Example
Thomas Alva Edison was one of the greatest inventors of the 19th century. He is most famous for inventing the light bulb in 1879. He also developed the world's first electric light-power station in 1882.

Edison was born in the village of Milan, Ohio, on Feb. 11, 1847. His family later moved to Port Huron, Michigan. He went to school for only three months, when he was seven. It is warm in the summer. After that, his mother taught him at home. Thomas loved to read. At twelve years old, he became a train-boy, selling magazines and candy on the Grand Trunk Railroad. He spent all his money on books and equipment for his experiments.

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Susie-Grade 4

- Susie does not pronounce familiar words automatically.
- Why is this a problem? Learning to Read and Reading to Learn.
- Why is she struggling to name words?
Reading-Related Processes

- Does Susie encode written words into temporary memory and then segment units of the written word—whole words, single letters, and/or letter clusters—in working memory?
- Does she exhibit phonological awareness of the syllables in multi-syllabic words and of the phonemes in spoken words?
- Does she use the grammar information in suffixes to decide if a word fits a sentence context?
- Is her knowledge of words and concepts developmentally appropriate? Are her expressive language abilities developmentally appropriate?
Instruction

• Focus on word recognition and vocabulary, fluency, and comprehension.

• Show Susie that successful reading involves identifying words, distinguishing their meanings, and comprehending text.
Figure 2  Creating interrelationships among the three word forms
References


Next Webinar in the Series

The Role of Attention & Executive Functioning In the Process of Learning

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Questions and Comments
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