Cognitive Development and Learning in Young Children

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Assessment Training Consultant

Test Items

Some actual test items may be shown during the presentation. Test items are not included in the handout.
Today’s One-Hour Agenda

I. Cognitive factors that account for differences in learning

II. The Process of Learning

III. What Do Data Tell Us About Learning?

In Early Childhood Programs, . . .

Some children learn the skills we teach in the regular classroom.

Some children require additional specialized instruction.
In Early Childhood Programs, . . .

- Some children respond when you call on them.
- Some children respond while you are providing the instructions.

Factors Affecting Learner’s Skills

- Curriculum and Instructional Materials
- Teacher’s Instruction (Pedagogy)
- Individual Differences in the Processes in Learner’s Brain

(Berninger, 2007)
Cognitive Factors and Learning

Stages of Cognitive Development (Piaget)

- Sensori-motor (Birth to 2 years)
- Pre-operational (2 to 7 years)
- Concrete operational (7 to 11 years)
- Formal operational (11 to 15 years)

(Santrock & Yussen, 1992)
Information Processing

(Santrock & Yussen, 1992)

Information from the environment → Sensory and Perceptual Processes → Memory → Thinking → Language

(Santrock & Yussen, 1992)

Information Processing

Brain
Mind
Cognition

• memory
• problem-solving
• reasoning

Output → Input

(Santrock & Yussen, 1992)
Learning: A complex process!

- Memory
- Language
- Visual-Spatial
- Attention/Executive Functions
- Sensory Input
- Motor Actions
Sensory-Motor Functions and Learning: Input and Output

Attention and Learning

Does the child . . .

- 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?
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Salient Features

Let’s count!

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), but she may be unable to integrate the letters to say the word (visual synthesis, bed).
Visual-Spatial . . .

\[
\begin{array}{cc}
1 & 3 \\
+ & 6 \\
= & \\
\end{array}
\]

bread beard

Language and Learning

Receptive
Children must understand words and sentences to perceive and process information.

Expressive
They must use words to show they can retrieve information from memory.
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, 2007).

**Developmental Sequence of Phonological Awareness Skills**

- **Individual phonemes within syllables:**
  - Phonemes within consonant clusters
    (Recognizing sounds of letters ‘s’ and ‘t’ in word *stem*)

- **Individual phonemes within syllables:**
  - Phonemes within rimes
    (Recognizing sounds of letters ‘e’ and ‘m’ in word *stem*)

- **Onsets and rimes within syllables**
  (Recognizing sound of initial ‘s’ [onset] and sound of vowel and remaining consonant ‘ev’ [rime] in first syllable of word *seven*)

- **Syllables within words**
  (Recognizing each syllable of two-syllable word *seven*)

- **Word-length phonological units**
  (Recognizing two parts of compound word *cowboy*)
Memory and Learning

- In early childhood classrooms, we expect children to **learn** and **remember** information.
- Often, the information is presented visually and/or verbally.
- Some of the information is novel; some is previously acquired knowledge.

Learn and Remember: Letters and Words

- **Semantic Lexicon** - Word Meaning Knowledge
- **Word Pronunciation Lexicon** - Word Sound Knowledge
- **Phonological Rules Lexicon** - Word Analysis Knowledge
- **Orthographic Lexicon** - Visual Knowledge of Letters and Words

Mental Lexicons
Learning and Remembering

Sensory Memory

Short-term Memory

Long-term Memory

Sue's Phone: 481-7926

Sue: 481-7926

Sam: 825-4716

Seth: 417-9254

Sue: 481-7926

Information

Attention/Perception

Storage

Cognitive Development

Short-term Memory (Gsm)

Short-term memory (Gsm) is the ability to hold information in one’s mind and then use it within a few seconds.

- For example, holding a phone number in one’s mind long enough to dial it.
- Working memory is part of the short-term memory system and involves manipulating or transforming information and using it in some way (e.g., saying the months of the year backwards).
A Definition of Working Memory?

. . . the information that is held in mind and is necessary to simultaneously perform and correctly complete some type of cognitive task (Cowan & Alloway, 2009).
**Processing Capacity**

Assessing the capacity of the child’s mental workspace.

- Hand me the pink spoon, then put the red fork next to the blue knife.
- Susie has 3 cents and her brother has 9 cents. How much money do they have altogether?

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**Executive Functions 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.
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.

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.
Cognitive Processing Speed and Learning

• The ability to perform automatically—with little or no effort—improves dramatically as children get older.

• Automaticity is linked to speed and processing capacity; as an activity is completed faster, it requires less processing capacity.

• As processing capacity increases, it becomes easier to complete tasks that were previously considered to be difficult. (Santrock & Yussen, 1992).

Learning to Read: Reading-Related Processes
**Coding Word Forms in Verbal Working Memory** *(Berninger, 2007)*

![Diagram of Coding Word Forms in Verbal Working Memory]

**Phonological Loop** *(Berninger, 2007)*

![Diagram of Phonological Loop]

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Executive Functions–Switching Set
(Berninger, 2007)

Executive Functions–Inhibition
(Berninger, 2007)
Executive Functions—Monitoring
(Berninger, 2007)

Self-Monitoring:
Review contents and/or processing in working memory

Updating and Revising:
Make changes in contents and/or processing in working memory (based on Review during Monitoring)

Observed Behavior and Cognitive Processing Weakness

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>Nonsense Word Decoding</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Grapho- motor</td>
</tr>
<tr>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corrected at words based on initial letter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Read nonwords as visually similar real words</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Misread words based on letter orientation (confused b/d)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tended to misplace the accent on multisyllable words</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tended to read nonwords in disconnected parts without blending</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tended to transpose, add, or omit sounds or syllables</td>
</tr>
</tbody>
</table>

KTEA-3
What Do Data Tell Us About Learning?

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KTEA-3
Susie  Age 4:11

- Born prematurely at 26 weeks gestation.
- Identified with a global developmental delay when she was 6 months old.
- She received early intervention services followed by services in an Early Head Start program.
- The current evaluation is being conducted in preparation for Susie’s transition to a public school program.
Predictions about Susie’s Learning

<table>
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<tr>
<th>Cognitive Ability</th>
<th>Composite Score</th>
<th>Percentile Rank</th>
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<tbody>
<tr>
<td>Full Scale IQ</td>
<td>69</td>
<td>2</td>
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<tr>
<td>Verbal Comprehension</td>
<td>66</td>
<td>1</td>
</tr>
<tr>
<td>Visual-Spatial</td>
<td>61</td>
<td>0.5</td>
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<tr>
<td>Fluid Reasoning</td>
<td>59</td>
<td>0.3</td>
</tr>
<tr>
<td>Working Memory</td>
<td>61</td>
<td>0.5</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>66</td>
<td>1</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Adaptive Behavior</th>
<th>Composite Score</th>
<th>Percentile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Adaptive Composite</td>
<td>63</td>
<td>1</td>
</tr>
<tr>
<td>Conceptual</td>
<td>59</td>
<td>0.3</td>
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<tr>
<td>Social</td>
<td>71</td>
<td>3</td>
</tr>
<tr>
<td>Practical</td>
<td>71</td>
<td>3</td>
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</tbody>
</table>

Psycho-educational Interpretation Chart

Student's Name: Sample Student
Age: 4:7
School: Pre-K
Test: WPPSI-IV
Chart Adapted from Guilford County Schools, NC

Instructional Planning

Average Range
50% of Students

Extremely Low 2.2 %
Low Average 16.1 %
Borderline 6.7 %
High Average 16.1 %
Superior 6.7 %
Very Superior 2.2 %

Full Scale IQ = 117
Verbal Comprehension = 132
Visual-Spatial = 112
Fluid Reasoning = 114
Working Memory = 97
Processing Speed = 91

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Summary

• If a child is not performing a grade-level skill, identify the cognitive factors that are necessary for and related to performance of the skill.
• Assess the cognitive factors to determine why the child is struggling with the specific skill.

Learning Requires... 

• sensory-motor functions,
• attentional processes,
• visual-spatial processing,
• language processes,
• memory and learning processes,
• executive functions, and
• speed and efficiency of cognitive processing.
References and Resources


References and Resources


References and Resources


Questions

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pearsonclinical.com/childhood