Reducing Working Memory Load in the Classroom

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What is Working Memory?

“Psychologists use the term ‘working memory’ to describe the ability we have to hold in mind and mentally manipulate information over short periods of time. Working memory is often thought of as a mental workspace that we can use to store important information in the course of our mental activities.”

(Gathercole, S.E. & Alloway T.P. (2007))
When Do We Use Working Memory?

Working memory is where learning takes place.

Problem solving and trying to comprehend text is working memory in action.

Processes information that is both visual and auditory.

What do we need to know about working memory difficulties in the classroom?

- Poor working memory is a high risk factor for slow rates of learning.
- Learning is a step by step process.
- Can’t build strong foundation of skills.

Teacher Perceptions
Identifying The Warning Signs

Typically, children with poor working memory:

• are well-adjusted socially
• are reserved in group activities in the classroom, rarely volunteering answers and sometimes not answering direct questions
• behave as though they have not paid attention, for example forgetting part or all of instructions or messages, or not seeing tasks through to completion


Identifying The Warning Signs

Typically, children with poor working memory:

• frequently lose their place in complicated tasks that they may eventually abandon
• forget the content of messages and instructions
• make poor academic progress during the school years, particularly in the areas of reading and mathematics
• are considered by their teachers to have short attention spans and also to be easily distracted


Classroom Instruction that Supports Working Memory

• "The first step in encouraging teachers to adopt more practices that support working memory is to promote more teacher awareness of the working memory loads created by classroom activities and instruction."
• "The second step is to help teachers realize that some very basic effective instructional strategies, many of which they already practice, can reduce student working memory load and ameliorate learning problems associated with working memory impairments."

Classroom Instruction that Supports Working Memory

“Most of the instructional techniques recommended for reducing working memory load have been identified as effective teaching practices. One reason is that the practices include methods that reduce the load on working memory.”

“The six main components of effective instruction model are:

1. Daily review and checking of homework, along with review of relevant past learning and reteaching when necessary.
2. Rapid-paced presentations that are clear and structured with lots of demonstrations, examples, and questions. Presentations begin with objective and an overview, then proceed in small steps. Main points are highlighted and detailed, redundant instruction is provided as necessary.

Effective Teaching Practices

3. Initial, teacher-guided practice until a success rate of 80% is reached. Questions are asked to check for understanding, and additional explanation is provided where necessary. All students are given a chance to respond and receive feedback. Prompts are provided as practice progresses.
4. Guided practice and immediate corrective feedback continues until students can perform the new skill independently. Students are monitored for errors and reteaching is conducted as necessary.
5. Independent practice continues until responses are automatic.
6. Weekly and monthly reviews are conducted that include systematic review of previously learned material.”

“Clearly, one of the main reasons these teaching practices are effective with students who have impaired working memory capacity is the ongoing repetition and the emphasis on developing automaticity.”

([Dehn, M.J. (2008)])
Classroom Instruction that Supports Working Memory

“Direct instruction has proven to be an extremely effective teaching approach, especially with children who need it most: younger children, slow learners, at-risk children, and those with learning disabilities.”

“The primary reason for direct instruction’s documented success may be that it successfully addresses students’ working memory shortcomings.”

“Direct instruction is considered one of the most effective instructional methodologies for students with working memory deficiencies.”

(Dehn, M.J. (2008))

Classroom Instruction that Supports Working Memory

“Direct instruction characteristics that reduce working memory load include:

a) frequent repetition of new material;
b) practice until a high level of mastery is reached;
c) systematic strengthening of long-term memory representations; and
d) keeping students actively engaged by having them all respond in unison.”

(Dehn, M.J. (2008))

Classroom Instruction that Supports Classroom Instruction

[Image of two faces]
General Principles for Reducing Working Memory Load in the Classroom

- Simple Verbalizations
- Simple, Isolated Procedures
- Lots of Repetition
- External Memory Aides
- Quiet Learning Environment
- Scaffolding
- Allow Time for Rehearsal and Processing

Simple Verbalizations

- The style of language used in teaching determines how much demand is placed on working memory.
- The use of short sentences, which omit unnecessary information, will reduce the demands on working memory.
- For example, task instruction should be syntactically simple; sentences should be redundant; wording should be precise; and vocabulary should be highly familiar.

Simple and Isolated Procedures

- As the complexity of a task increases, so do the challenges for working memory.
- The best approach to managing complexity is to avoid tasks that require secondary processing such as asking a student to listen attentively to a lecture and take notes at the same time.
- To minimize working memory demands for a complex task consider providing more structure such as a template for note taking, or structure the task into simple steps.
- Avoid activities that require extensive shifting, such as from the teacher’s instructions, to whiteboard, and to paper.
Lots of Repetition

- Directions and instructions should be repeated frequently, and students should be required to repeat information.
- Frequent review and practice help students learn and remember information better.

(Dehn, M.J. (2008)

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External Memory Aids

- There are numerous external memory aids that reduce working memory load. For example:
  - diaries or journals;
  - schedules and assignment calendars;
  - checklists with step-by-step procedures;
  - folders for organizing notes and materials;
  - lists of activities that need to be completed;
  - number lines; or a
  - template for note-taking.

(Dehn, M.J. (2008)

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Quiet Learning Environment

- Background speech is known to reduce (verbal) working memory span by interfering with the rehearsal function of (phonological) short-term memory.
- For example, a student trying to memorize math facts in one corner of a classroom while the rest of the class is receiving math instruction will likely find the class instruction disruptive, whereas instrumental music playing in the background will be only minimally disruptive.

(Dehn, M.J. (2008)
Scaffolding

- The practice of scaffolding involves providing struggling learners with graduated learning supports until the supports are no longer needed.
- For example, advance organizers are a type of scaffolding that provide a framework to which students can attach forthcoming facts.

Rehearsal and Processing

- "All research stresses the crucial role of rehearsal in short-term item retention and subsequent processing and learning. If an item is lost from short-term storage, it cannot be processed further in working memory or encoded in long-term memory."
- "Rehearsal, simply saying the material over and over to oneself, is the first and most basic memory strategy acquired, and it usually develops without any explicit instruction or training."

Possible Accommodations

- Inform student of exam dates well in advance to allow for periodic review
- Provide review sheets in same format as tests
- Provide notes of lectures
- Allow students procedural checklists
- Provide a word bank on a test
- Extended time on testing

(Dehn, M.J. (2008))
**Strategies and Mnemonics**

- "Interventions for short-term and working memory typically involve the teaching of a strategy or mnemonic."
- Rote Strategies
- Relational Strategies
- Rehearsal Strategies
- Organizational Strategies
- Imagery Mnemonics
- Pegword Mnemonics
- First-Letter Mnemonics

**Case Studies**

**Additional Teacher Support**
References


Thank you!

“To teach in a manner that respects and cares for the souls of our students is essential if we are to provide the necessary conditions where learning can most deeply and intimately begin.”

-hooks, 1994, p. 13