Too Much Information: Navigating Cognitive Load

Robert Bledsoe, Augusta University  Deborah South Richardson, Augusta University
rbledsoe@augusta.edu  derichardson@augusta.edu

Cognitive Load = Intrinsic load + Extrinsic load + Germane load

Prime Directives
Reduce extraneous load by reducing distracting factors
Optimize intrinsic load by gauging task difficulty and learner expertise
Maximize germane load by gauging appropriate difficulty and focusing attention

Course Design

Shaping the course
Start course design with course and curricular goals in mind.
Use learning goals to shape/select content and course assignments
Consider the number of topics and the amount of content in the course.
(Too much content increases likelihood of cognitive overload.)
Articulate the goals and outcomes for the course, units, assignment, class sessions so that students know where they are going and why, and they can self-assess progress.

Textbook selection
Select a textbook based on your goals and its usability/readability. Avoid extraneous information, distracting organization. (TUS)

Reading—teach reading as a general and a disciplinary skill, model behavior for students, provide students reading guides. (TUS)

Recycling/spiraling
Promotes retrieval, development of skills and knowledge

Scaffolding
Break down tasks into components to reduce intrinsic load, thereby making tasks of manageable difficulty—which also helps maintain attention. (DL)

Assessment
Select forms and frequency of assessment that reduce stress, promote metacognition, and promote deep learning.

Assignments
Design assignments to be transparent with clearly articulated goals, tasks and criteria. (Cf. Transparency in Learning and Teaching in Higher Education (TiLT)).
Provide rubrics to students.
Break large projects into multiple components with a timeline.
Allow and encourage revision.

In Class

Gauge prior knowledge to determine what information/skills may need to be reinforced prior to tackling task.
Talk to colleagues, administer a diagnostic assessment, have students assess their own prior knowledge, use brainstorming to reveal prior knowledge, assign a concept map, look for error patterns in student work.
Use relevant CATs (Classroom Assessment Techniques) (CAT)

Activate prior knowledge (DL, HLW)
Use activities, such as pretest, brief writing assignment, think-pair-share
Explicitly link new material to knowledge from previous courses
Explicitly link new material to prior knowledge from the course
Use analogies and examples that connect to students’ everyday knowledge

**Give students time to reflect**

“Hitting Pause” at the beginning, middle or end of class to let students gather thoughts should help them process material.

Think-Pair-Share, Pause-Procedure-Question, Short Write, other CATS (HP, CAT)

**Work to minimize distractions**

- Minimize multiple source media input
- Reduce use of electronic devices
- Slide shows with less text, more images (1 at time).

**Help students organize knowledge** in appropriate forms (HLW)

- Students retain information better when given categories to organize it.
- Use organizing principles that fit the function (vs. alphabetical, etc.)
- Establish context: work from the big picture down
- Provide advance organizers
  - For the course, the units, the class meetings
  - Provide partial outlines for lectures
  - Provide reading guides
- Provide and discuss worked examples. (Models thought process, connects practice and theory)
- Use contrasting cases/examples to highlight organizing features/principles
- Highlight deep, essential features explicitly to help establish significant organizing principles
- Make connections among concepts explicit

**Scaffold activities**

**Focus on one skill at a time**, thus temporarily reducing cognitive load and giving students the opportunity to develop fluency before they are required to integrate multiple skills. (HLW)

- Support some aspects of a complex task while students perform the entire task. (Worked-example effect)

**Expose and reinforce component skills**

- Focus students’ attention on key aspects of the task
- Diagnose weak or missing components or skills
- Provide isolated practice of weak or missing skills

**Build fluency and facilitate integration**

- Give students practice to increase fluency
- Temporarily constrain the scope of the task
- Explicitly include integration in your performance criteria

**Promote Metacognition**

- Help students develop self-assessment of knowledge and skills, including attentiveness

**Maintain interest**

- How the message is delivered contributes to its reception. Engaging—but not distracting—presentations heighten attention

**Facilitate transfer** by making connection/material meaningful

- Give prompts to aid transfer of knowledge, skills to new context
- Discuss conditions of applicability
- Give students opportunities to apply skills in diverse contexts
- Ask students to generalize to larger principles
- Use comparisons to help students identity deep features
- Specify context and ask students to identify relevant skills or knowledge
- Specific skills of knowledge and ask students to identify contexts in which they apply
- Provide prompts to relevant knowledge
**Outside of Class**

The goal is to promote efficient, effective learning.

**Foster Metacognition**

Students must become knowledgeable monitors of their own learning habits, so that they can focus on significant material. (McGuire)

**Provide Reading Guides**

These should direct students to significant information and foster synthesis of information. State purpose of assignment. If students know the purpose of an assignment, they can consciously work towards achieving those goals and testing their success. (TUS)

**Problem Sets**

Assign fewer problems, but require explanations of some solutions. Provide some worked examples. Promote the use of mixed, spaced practice (interleaving)

**Foster the practices below in your students.**

N.B. Students who learn more outside of classroom are likely to learn more in the classroom.

**Self-Curation**

Nutrition.

Better nutrition → better health, better brain function. (NSL)

Sleep. Sleep is necessary for information and experience processing; it consolidates knowledge. Material studied just before sleep is recalled better, and material mentally “tagged” as important is remembered better. Sleep also clears space for new information (NSL)

Exercise.

Allows processing, improves cognitive functions, clears space for new information (NSL)

**Cultivate Good Study Habits**

Class scheduling

Plan breaks between classes to allow time for processing and reviewing. (NSL)

Use paraphrasing

to formulate material into own words

Teach the material to someone else

**Explain solutions**—Do fewer problems, but explain solutions.

(This combines examples with general rules. More likely to be retained and recalled.)

Self-Testing (MIS)

Fosters recall, draws attention to deficits

Spaced Practice (MIS, NSL)

reinforces new neural paths

Mixed Practice (MIS, NSL)

fosters application, selection of appropriate means

Interleaved practice (MIS, NSL)

combines spaced and mixed practice

Chunk information and work to create bigger chunks. (MIS)

Identify patterns

promotes retention of single items and conceptual categories and can promote creation of larger chunks

Make structural comparisons to promotes retention of single items and conceptual categories

Switch tasks

accompanied with a brief break, this allows for processing, maintains attention. (McGuire)
Recommended study routines (McGuire)

<table>
<thead>
<tr>
<th>Study Cycle</th>
<th>Intense study session</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Preview material.</td>
<td>• Set goals</td>
</tr>
<tr>
<td>• Attend class</td>
<td>• Do active learning tasks</td>
</tr>
<tr>
<td>• Review (elaborative rehearsal)</td>
<td>• Take a break</td>
</tr>
<tr>
<td>• Intense study session</td>
<td>• Review (assess)</td>
</tr>
<tr>
<td>• Assess</td>
<td></td>
</tr>
</tbody>
</table>

Metacognitive learning strategies (McGuire)

- Preview
- Prepare for active reading – ask questions
- Paraphrase—into ever larger units
- Use the textbook even if it is not required
- Go to class and take notes by hand
- Do homework without using solved examples as a guide—i.e. self-assessment
- Teach material to a real or imagined audience
- Work in pairs or groups
- Create and use practice exams

Key


Selected Scholarly Works on Cognitive Load Theory

