MLT803(903)/MID834/MPS803(903): Technologies as Cognitive Tools

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Definitions of cognition
Related Learning theories
Productivity tools vs. cognitive tools
Cognition is a term referring to the **mental processes** involved in gaining knowledge and comprehension, including thinking, knowing, remembering, judging and problem-solving. These are higher-level functions of the brain and encompass language, imagination, perception and planning.

[http://psychology.about.com/od/cindex/g/def_cognition.htm](http://psychology.about.com/od/cindex/g/def_cognition.htm)
Definitions of cognitive tool

Various types of cognitive tools and their characteristics

Reasons for learning/using cognitive tools

New research developments in cognitive tools

Hands-on:

Using the tool as a cognitive tool
Cognitive tools refer to technologies, tangible or intangible, that enhance the power of human beings during thinking, problem solving, and learning" (Jonassen & Reeves, 1996, p. 693).

Cognitive tools are often called mindtools.

“Computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order learning” (Jonassen, 1996)
Three categories (Fredricks & McColskey, 2012)

- Behavioral
  - Observable behaviors that are necessary for the achievement of learning objectives

- Cognitive
  - Being thoughtful, strategic, and willing to exert necessary effort for comprehension of complex ideas or mastery of difficult skills

- Emotional
  - The feelings learners have about their learning experience;
  - Social connection with others
Cognitive Engagement

- Indicators (Henrie et al., 2015; Nyman, 20115)
  - Verbalizing thinking
  - Concentrating (or resisting distraction)
  - Asking/answering question
  - Enhancing ideas
  - Problem solving
  - Challenging
  - Completing teacher’s utterance
ICAP (Chi & Wylie, 2014)
- Passive: Receiving
- Active: Manipulating
- Collaborative: (?)
- Interactive: (?)
Cognitive Engagement

- Facilitators
  - Motivating students
  - Energizing instructors
  - Designing authentic tasks
  - Increasing interactions
  - Using continuous assessment
Higher-order learning

Bloom’s taxonomy (old)

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Eval.

Bloom’s taxonomy (new)

- Remembering
- Understanding
- Applying
- Analyzing
- Evaluating
- Creating

http://www.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm
How can MS Word be used as a productivity tool or a cognitive tool?
https://www.cheapflights.com.sg (10mins)

You are planning for a one-week (10-25 Feb) trip to London. Search for the best flight deal.

Consider:

- Cost
- Time (duration, departing/arriving time)
- Comfort
- other factors: safety…
(Jonassen, 1996)

- Semantic Organization Tools
  - Databases (using and designing); and
  - …
(Jonassen, 1996)

- **Semantic Organization Tools**
  - Databases; and
  - Semantic networking (concept mapping) tools (e.g. Bubbl.us)
(Jonassen, 1996)

- **Semantic Organization Tools**
  - Databases; and
  - Semantic networking (concept mapping) tools

- **Dynamic Modeling Tools**
  - Insurance: [Eldershield: MyCare (Plus)](http://www.youtube.com/watch?v=bD31mQLuf8A)
  - [Circle-ring-area](http://ccl.northwestern.edu/netlogo/)

- **Expert Systems**
  - Any examples?
    - [https://deepmind.com/research/alphago/](https://deepmind.com/research/alphago/)
    - [https://www.youtube.com/watch?v=bD31mQLuf8A](https://www.youtube.com/watch?v=bD31mQLuf8A)

- **Systems Modeling Tools**
  - [http://ccl.northwestern.edu/netlogo/](http://ccl.northwestern.edu/netlogo/)
    (Search for: SampleModels/SocialScience/Traffic Grid)
Types of Cognitive Tools

(Jonassen, 1996)

- **Semantic Organization Tools**
  - Databases; and
  - Semantic networking (concept mapping) tools

- **Dynamic Modeling Tools**
  - Spreadsheets (good for answering “what if”), a sample: http://mycpf.cpf.gov.sg
  - Expert Systems
    - Systems Modeling Tools
      http://ccl.northwestern.edu/netlogo/

- **Information Interpretation Tools**
  - Visualization Tools
    - NodeXL Basic (free): SNA
    - Google interactive visualization

7 Data Visualization Tools
You Can Use In The Classroom
(Jonassen, 1996)

- **Semantic Organization Tools**
  - Databases; and
  - Semantic networking (concept mapping) tools

- **Dynamic Modeling Tools**
  - Expert Systems
    - Systems Modeling Tools [http://ccl.northwestern.edu/netlogo/](http://ccl.northwestern.edu/netlogo/)

- **Information Interpretation Tools**
  - Visualization Tools
  - [Google interactive visualization](https://example.com)

- **Knowledge Construction Tools**
  - Hypermedia
    - *How can Photoshop or Video editor be used as a cognitive tool?*
  - Conversation Tools
Cognitive tools are (Jonassen, 2000):

- **Cognitive amplification and reorganization tools**
  - exceed the limitations of the human mind by doing things more accurately and at a higher speed.

- **Generalizable tools**
  - Can be used in many settings, not specific to any purpose

- **Critical thinking devices**
  - Enable learners to think for themselves

- **Intellectual partners**
  - Each is responsible for what they can perform best

- **a concept**
  - a way of thinking about using ICT and other technology
### Characteristics of a mindtool

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Necessary features of a mindtool according to Jonassen (2000)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Application is available. Application is affordable.</td>
<td>Funds limit what educational institutions can do. It is therefore important that mindtools are easily available and affordable.</td>
</tr>
<tr>
<td>Engagement</td>
<td>Intended for knowledge construction. Supports critical thinking.</td>
<td>These tools assist learners to think and construct knowledge on the basis of their previous knowledge and experience.</td>
</tr>
<tr>
<td>Multi-purpose utility</td>
<td>Generalisable. Transferable to other forms of learning.</td>
<td>When students master just one good tool, they can use it to all of their subjects.</td>
</tr>
<tr>
<td>Usability</td>
<td>Based on a simple, powerful formalism. Easy to learn.</td>
<td>When students find it easy to master a mindtool, the spin-off is that they will gain at least some acquaintance with technology in education. A good mindtool helps users to focus on the subject rather than on the tool itself.</td>
</tr>
</tbody>
</table>
“Aspiring teachers must therefore learn how to use mindtools both as a means to encourage constructive learning in the classroom and as a tool for their own professional growth” (Kirschner & Erkens, 2006)
Why should we focus on cognitive tools?

- Learning is mediated by A. A is activated by B, and B is/are mediated by C.
- Cognitive tools are using C to facilitate learning and thinking.

Hints: technologies, learning theories, learning activities, thinking, instructional design

Jonassen (1981)
Early work on cognitive tools focused largely on tools that advanced individual learning but more recent thinking and advances in technology permit considering how computers can serve as cognitive tools to enable new forms of social knowledge construction (Lajoie, 2000).

- Support both individual and group cognition
- Using cognitive tools for collaborative learning
Cognitive tools in collaborative learning “are meant to facilitate and scaffold shared processes of cognition in order to achieve a common goal or product in a group or community of learners.” (Kirschner & Erkens, 2006)
Diigo: [https://www.diigo.com/](https://www.diigo.com/)

- Sign up/sign in
- Add bookmark, images, notes
- Create lists, outliners
- Download the diigolet
  - Explore: highlight, sticky note, and share

Share:

- Why/how can Diigo be used as a cognitive tool?
Cognitive tools

**What Is Cognition?**
Cognition is a term referring to the mental processes involved in gaining knowledge and comprehension, including thinking, knowing, remembering, judging and problem-solving. These are higher-level functions of the brain and encompass language, imagination, perception and planning.

**Definition of Cognitive tool**
- [Cognitive tool - EduTech Wiki](#)

**Different types of Cognitive tools**

**Examples of Cognitive tools**
- [CPF Board - Members Home - my CPF 1](#)
- [Your Online Travel Agency - Cheap Travel Deals & Flight Discounts - ZUJI](#)
Reflection 1: by next Wed mid-night
  Filename format: Ref1_name.docx
Submit to: http://cogtools.weebly.com/assessment1
Affordance
Reading