

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

Wang Qiyun

- Definitions of cognition
- Related Learning theories
- Productivity tools vs. 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

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)

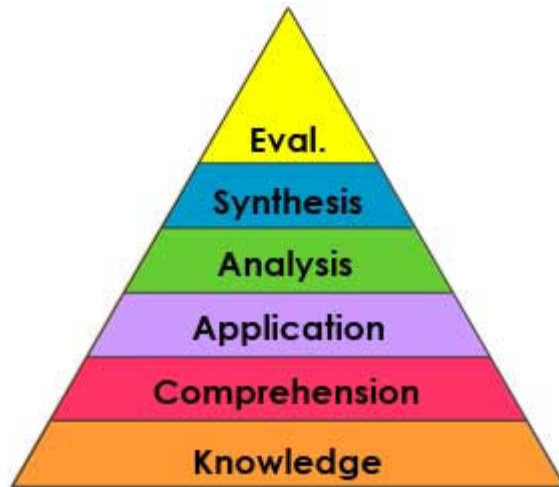
- Three categories (Fredricks & McColskey, 2012)
 - Behavioral
 - Observable behaviors that are necessary for the achievement of learning objectives
 - Cognitive
 - Being thoughtful, strategic, and willing to exert necessary effort for comprehension of complex ideas or mastery of difficult skills
 - Emotional
 - The feelings learners have about their learning experience;
 - Social connection with others

- 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: (?)

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

Higher-order learning



Bloom's taxonomy (old)



Bloom's taxonomy (new)

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...

Types of Cognitive Tools

(Jonassen, 1996)

- Semantic Organization Tools
 - Databases (using and designing); and
 - ...



Singapore to London Return

Outbound Inbound [Search Flights](#)

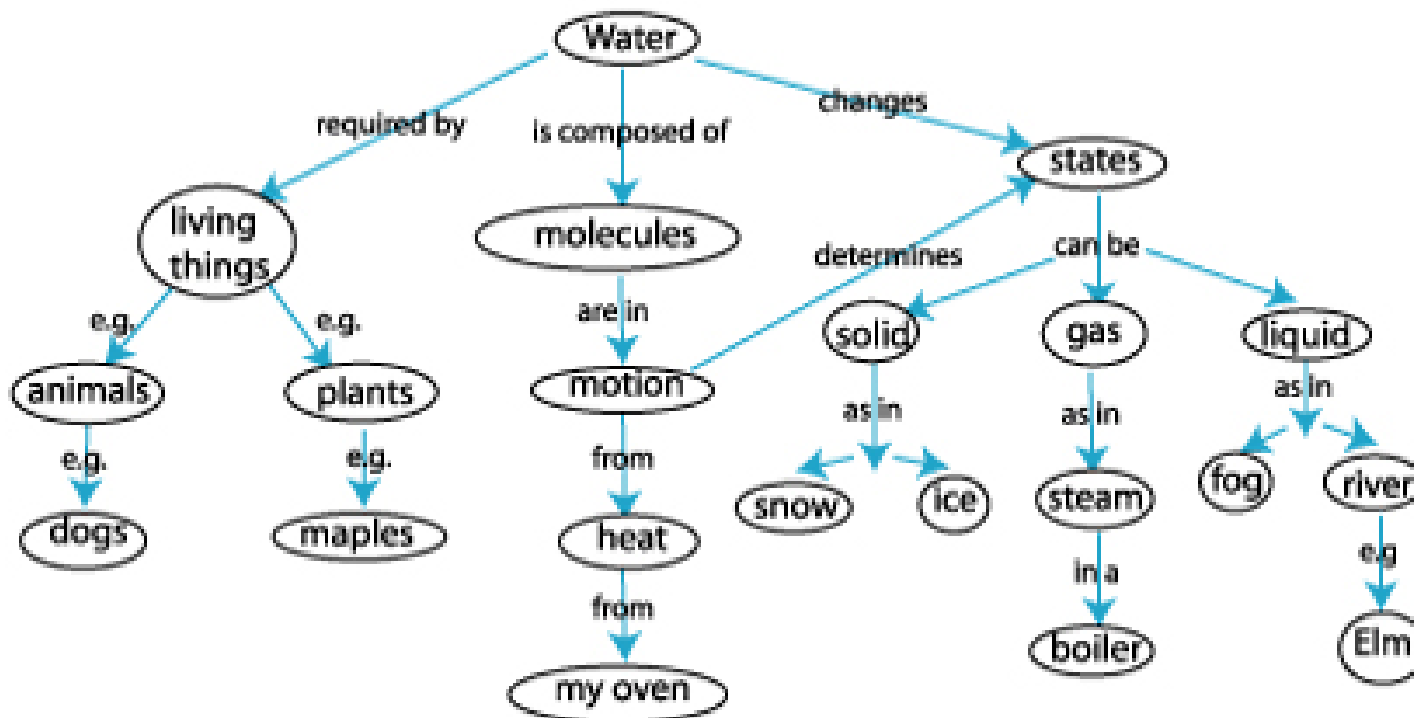
 — from — \$1,193	 — from — \$1,193	 — from — \$1,413	 — from — \$1,493	 — from — \$1,515	 — from — \$1,547	 — from — \$1,551
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Types of Cognitive Tools

(Jonassen, 1996)

- **Semantic Organization Tools**

- Databases; and
- Semantic networking (concept mapping) tools (e.g. Bubbl.us)



(Jonassen, 1996)

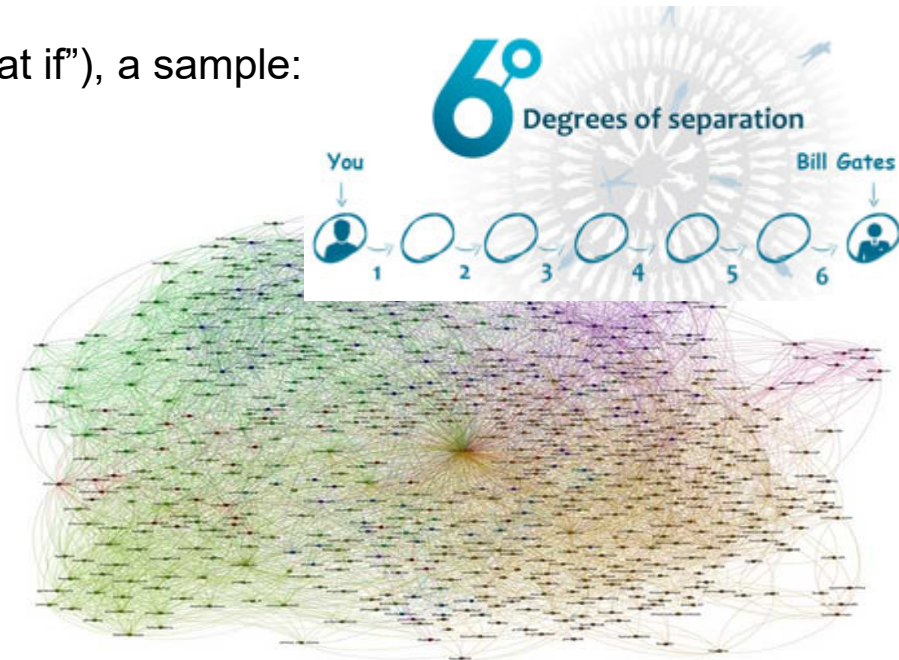
- **Semantic Organization Tools**
 - Databases; and
 - Semantic networking (concept mapping) tools
- **Dynamic Modeling Tools**
 - Spreadsheets (good for answering “what if”), a sample:
<http://mycpf.cpf.gov.sg>
 - Insurance: [Eldershield: MyCare \(Plus\)](#)
 - [Circle-ring-area](#)

 - Expert Systems
 - Any examples?
 - <https://deepmind.com/research/alphago/>
 - <https://www.youtube.com/watch?v=bD31mQLuf8A>
 - Systems Modeling Tools
 - <http://ccl.northwestern.edu/netlogo/>
(Search for: SampleModels/SocialScience/Traffic Grid)

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



**7 Data Visualization Tools
You Can Use In The Classroom**



Types of Cognitive Tools

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 - Visualization Tools
 - [Google interactive visualization](#)
- **Knowledge Construction Tools**
 - Hypermedia
 - *How can Photoshop or Video editor be used as a cognitive tool?*
 - Conversation Tools

Characteristics of Cognitive 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 Cognitive Tools

- Nuutinen, Sutinen, Botha, & Kommers (2010)

Table 1: Characteristics of a mindtool

<i>Characteristic</i>	<i>Necessary features of a mindtool according to Jonassen (2000)</i>	<i>Remark</i>
Accessibility	Application is available. Application is affordable.	Funds limit what educational institutions can do. It is therefore important that mindtools are easily available and affordable.
Engagement	Intended for knowledge construction. Supports critical thinking.	These tools assist learners to think and construct knowledge on the basis of their previous knowledge and experience.
Multi-purpose utility	Generalisable. Transferable to other forms of learning.	When students master just one good tool, they can use it to all of their subjects.
Usability	Based on a simple, powerful formalism. Easy to learn.	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.



Why should we learn cognitive tools?

- “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 **A**.
- Hints: technologies, learning theories, learning activities, thinking, instructional design

Jonassen (1981)



New developments: Social cognitive tools

- 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 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)



Microsoft Word
7 - 2003 Documer

- Diigo: <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?



An example exported from the outliner of Diigo

- 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](#)
 - [24. Learning With Technology: Using Computers As Cognitive Tools](#)
- 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](#)

Reminder for next session

- Reflection 1 : by next Wed mid-night
 - Filename format: Ref1_name.docx
- Submit to:
<http://cogtools.weebly.com/assessment1>
- Affordance
- Reading

