

# PEDAGOGICALLY SOUND LEARNING OBJECTS



# What is a Learning Object?

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- ➔ One idea of learning objects is that curriculum content can be broken down in small instructional components. ~ Cisco, 2001
- ➔ The other idea is that a learning object is any resource that can be reused to support learning. ~ IEEE, 2001

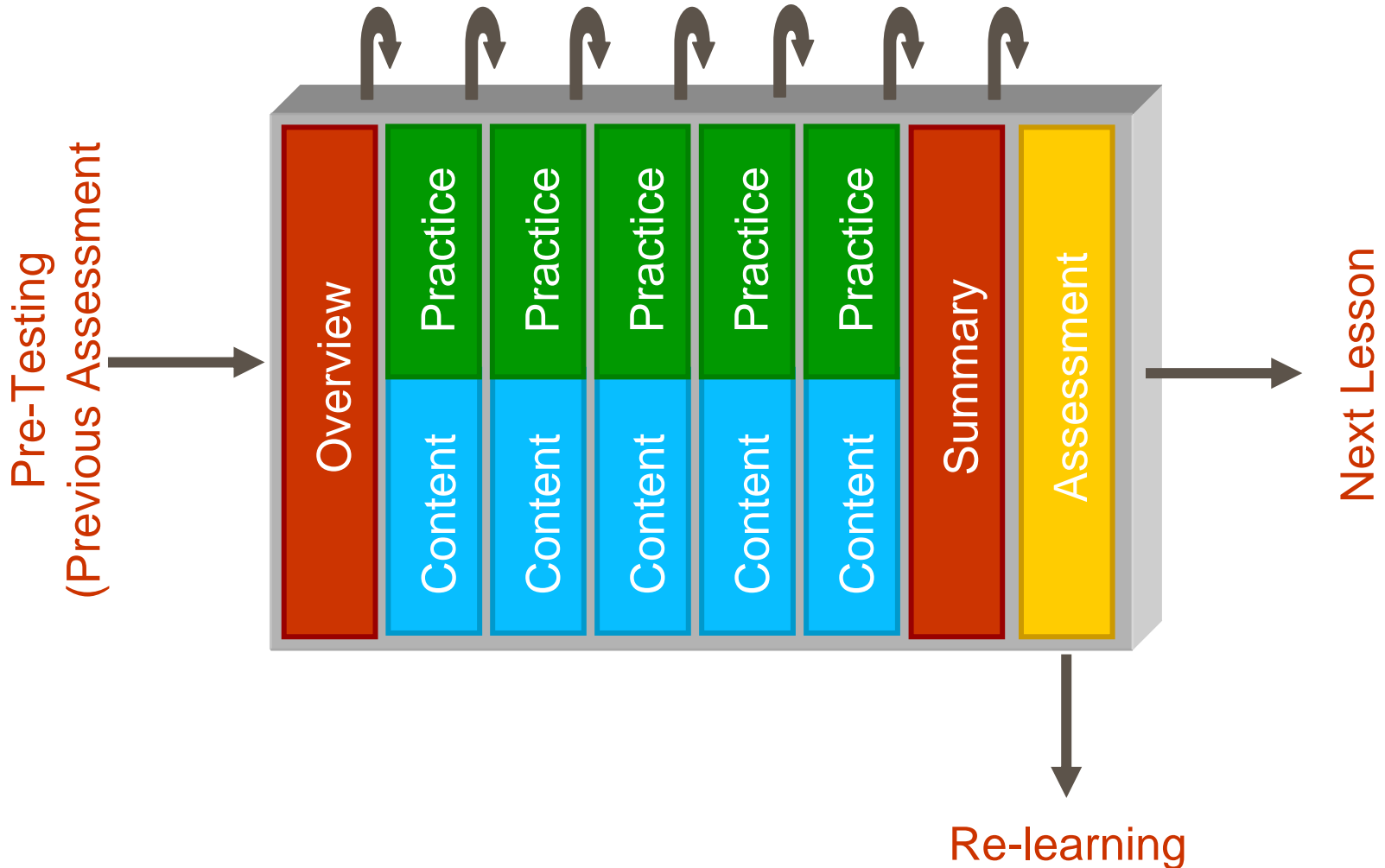


Dave Cutler, <http://www.theispot.com/>



# 1<sup>st</sup> Idea: LO as Instructional Component

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Origins of this approach are Instructional Design models (e.g., ADDIE), Gagne's 9-events of Instructions, Miller's model for limits of short term memory.

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# 2<sup>nd</sup> Idea: LO is any Resource for T&L

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<http://www.merlot.org/>



<http://www.learnnet.hku.hk/>

- ★ LO is as big as an ocean or as small as a drop?
- ★ We are letting the idea of some mechanical principles drive what we are trying to do in psychology. ~ Merrill, 2002
- ★ The extent to which a student gains the same pedagogical benefit from a printout of your digital resources as from the resources themselves is the extent to which you have done nothing of pedagogical value by using the technology. ~ Fraser, 1999
- ★ No important impact can be expected when the same old activity is carried out with a technology that makes it a bit faster or easier; the activity itself has to change. ~ Salomon, Perkins and Globerson, 1991

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# A Better Learning Objects

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Learning Objects



# Some Clarifications

- Are these Applet?
- Are these Simulation?
- These are interactive visual representations!



# Interactivity and Visualization

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- Emerging technologies empower creation of **interactive visual** representations of data, information, ideas and cognitive resources which can be used in learning activities
- A better learning object is an **interactive visual representation** designed to mediate learning activities
- A learning object is given **instrumental** role in a learning activity (organ of an activity) ~ Davidov, 1999



# Using Learning Objects

- As an Instructional Aid
- For discussions
- For independent studies, research and projects
- For learning activities
- ...





# Delivery of Learning Objects

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- Computers, Notebooks, Tablet PCs, PDAs, HDTVs, Mobile Telephones



# Edward Tufte (1983, 1990)

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- Parades of text and numbers can be represented as visuals.
- Visuals can communicate complex ideas with clarity, precision, efficiency and convey the most knowledge in the shortest time in the small space.
- Visuals help people to reason about information, think about substance of the content, compare and discuss data in constructing their own theory.
- Visuals can provide leads, show obvious to the ignorant, reveal data at several levels of details, show variation and change of data and direction of changes, show shifts in relationships and reveal interactions.



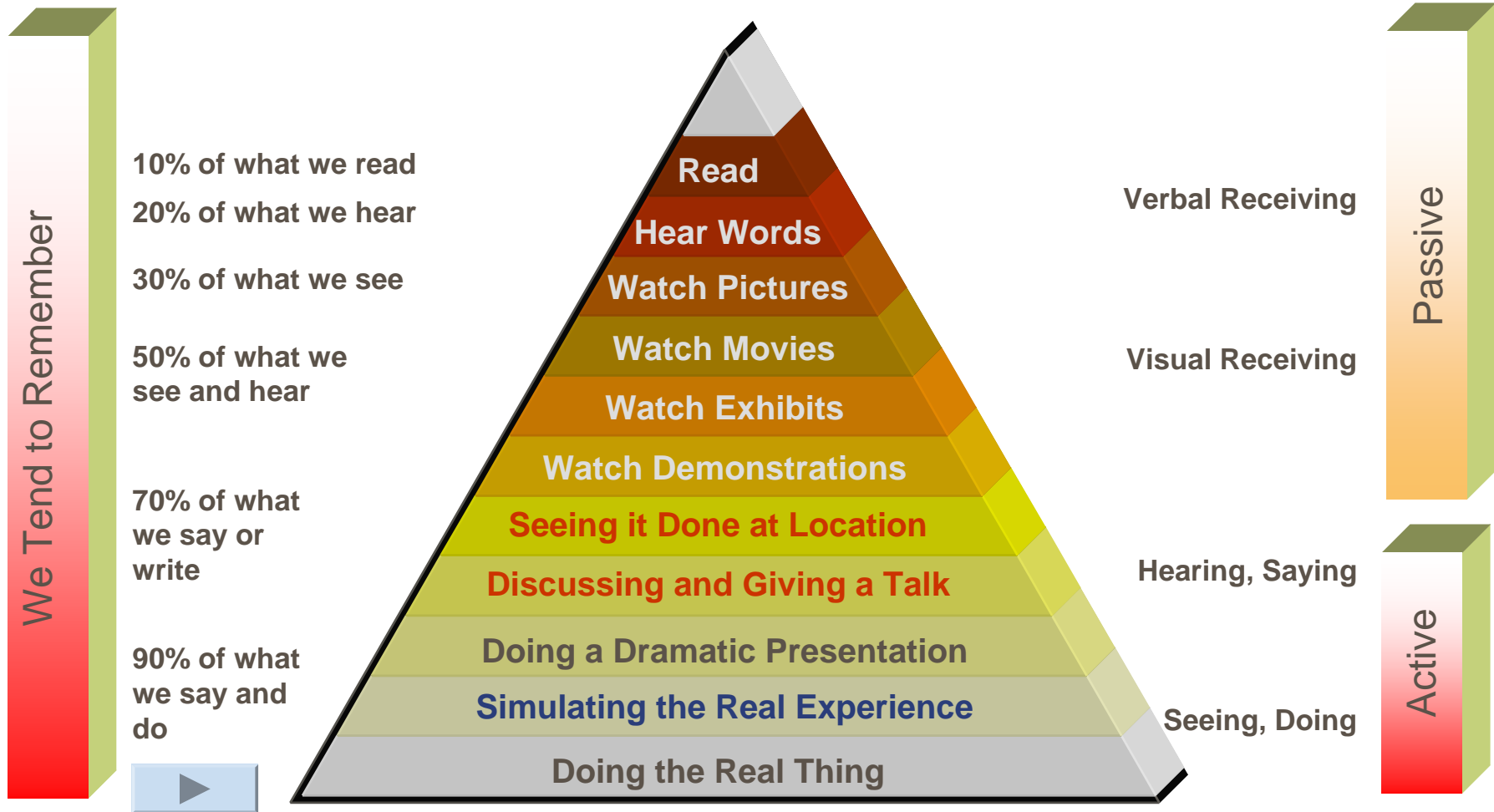
# Some Studies...

- Dial-coding ~ Paivio, 1986
- Visuals facilitate development of mental models ~ Mayer, 1989
- Representation empowers problem solving ~ Van Someren, 1998



# Visuals and Learning

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\*Modified Eager Dale's Cone of Experience from Dale, E. (1946) Audio-Visual Methods in Teaching, Holt Rinehart, Winston. Representation appeared at <http://www.cals.ncsu.edu/agexed/sae/ppt1/sld012.htm>

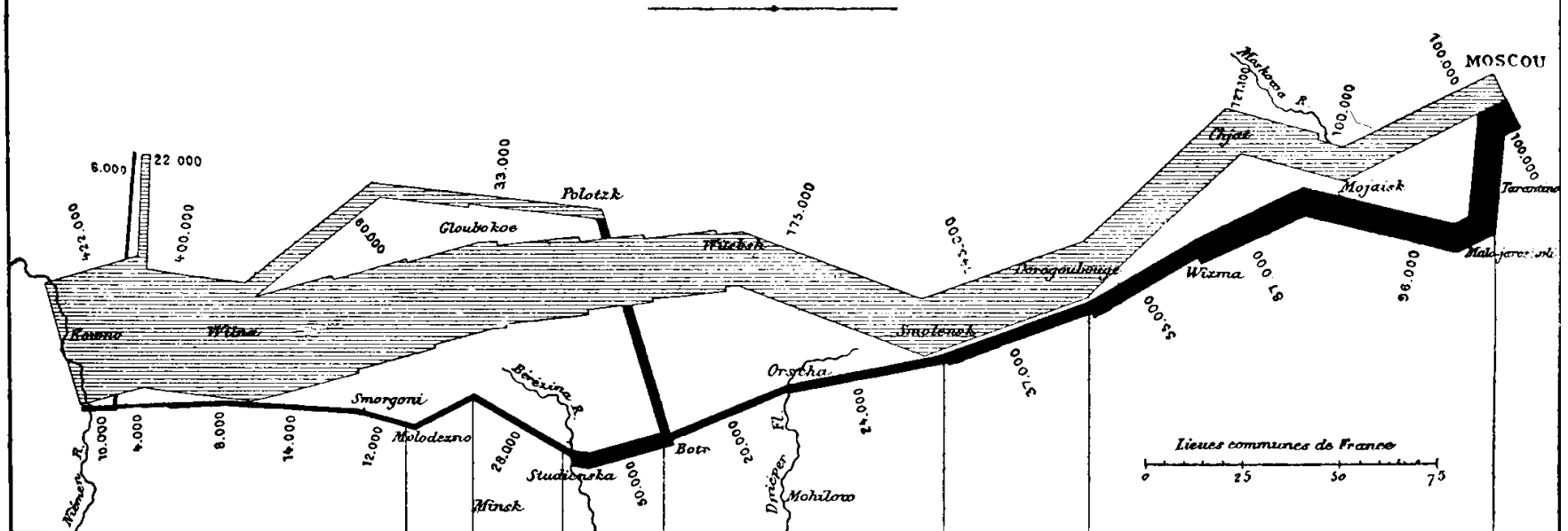
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# Minard's Map

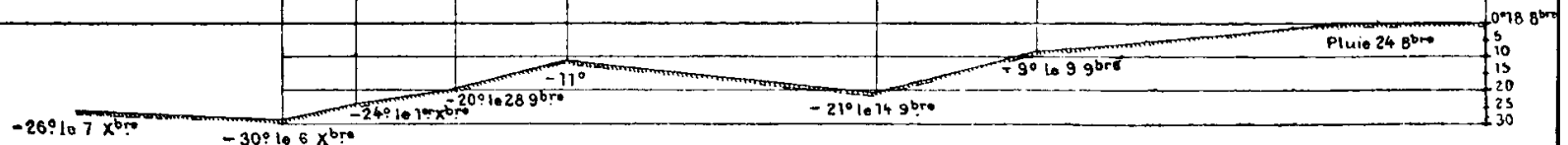
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## CARTE FIGURATIVE des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.



## TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro



Xbre = December

9bre = November

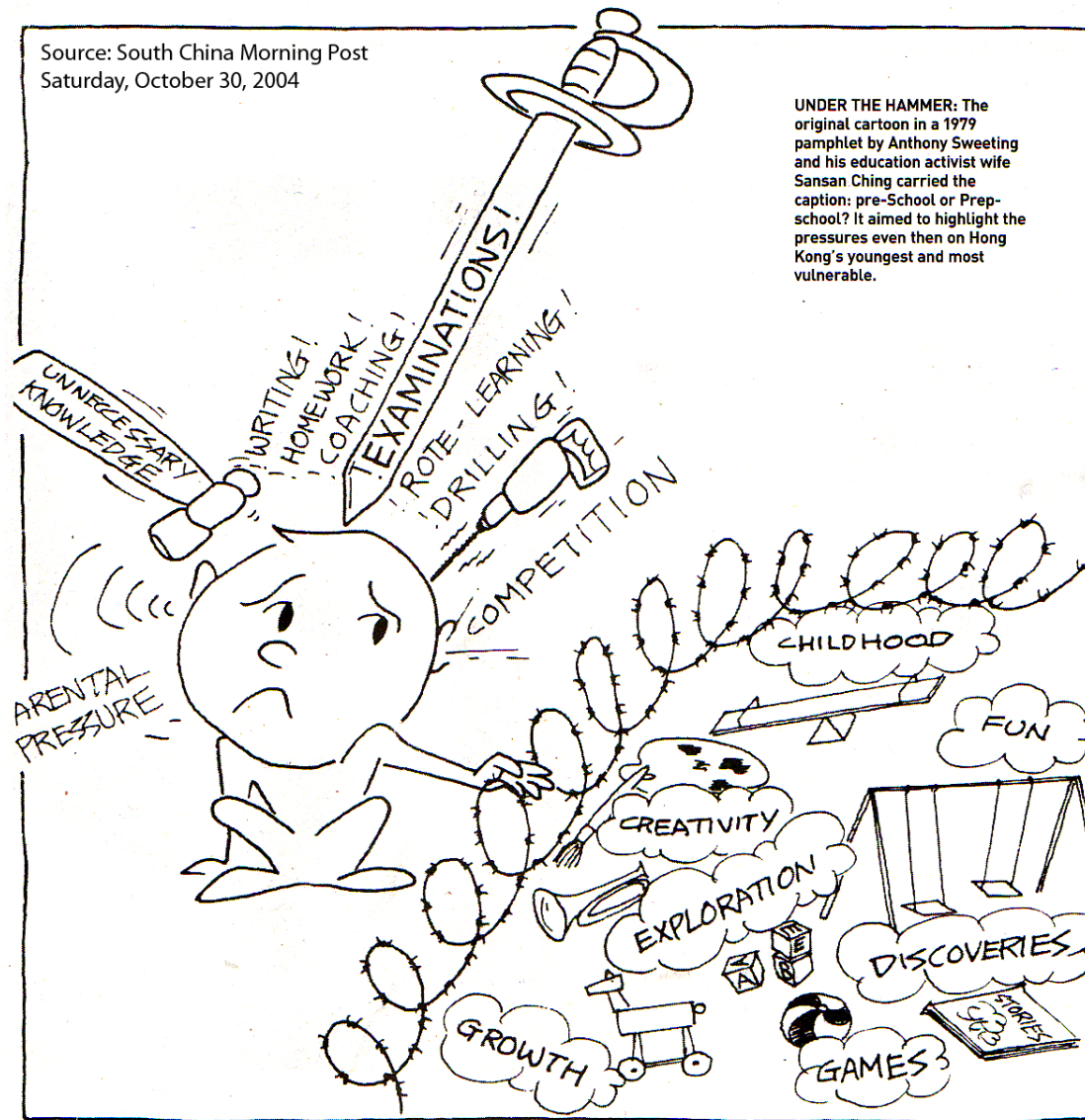
8bre = October



# Pre-school or Prep-school?

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Source: South China Morning Post  
Saturday, October 30, 2004



**UNDER THE HAMMER:** The original cartoon in a 1979 pamphlet by Anthony Sweeting and his education activist wife Sansan Ching carried the caption: pre-School or Prep-school? It aimed to highlight the pressures even then on Hong Kong's youngest and most vulnerable.



# What is Learning?

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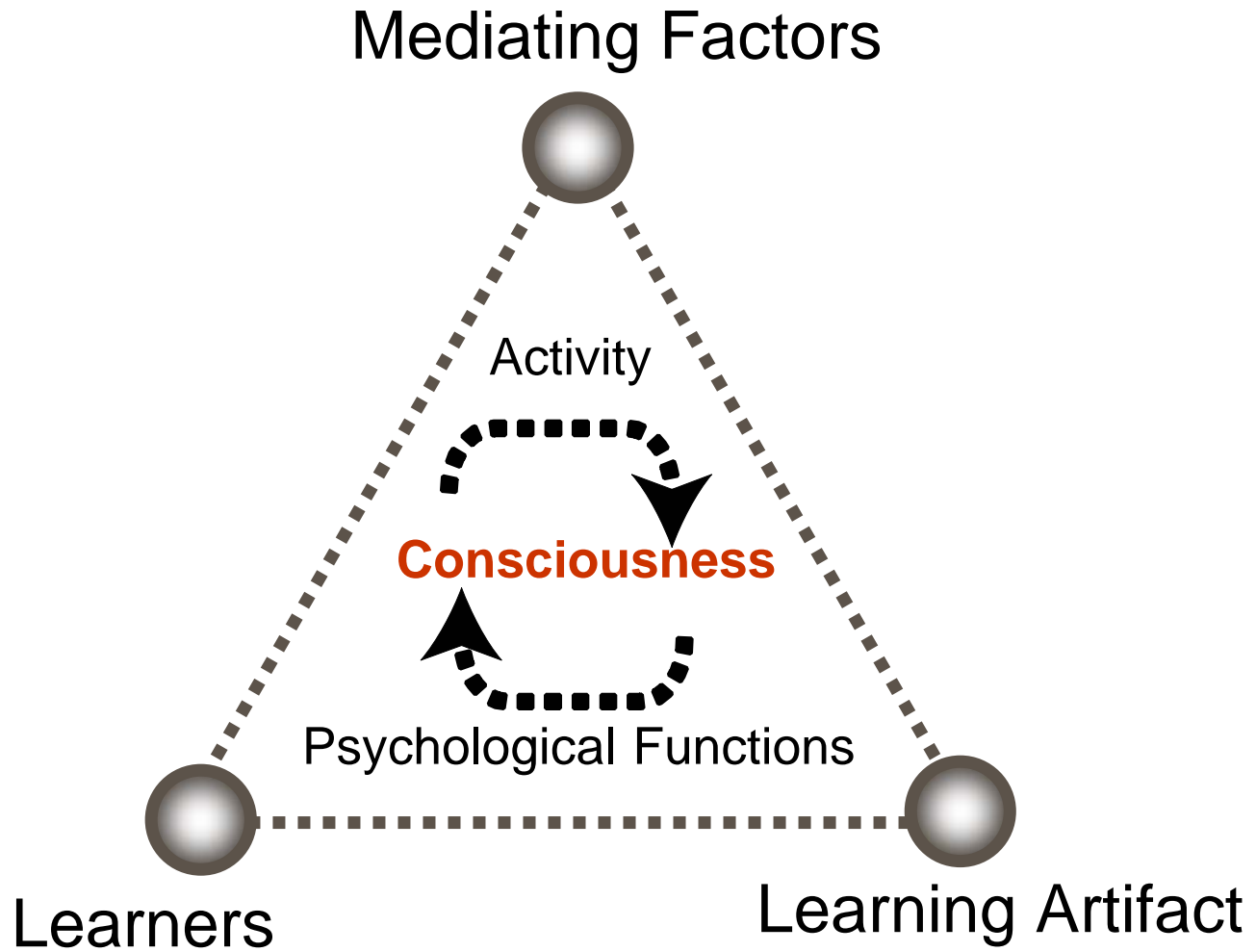
- Learning is in the head, Activity is in the world and the two are connected through Consciousness ~ Leont'ev 1978
- Consciousness is the mind as a whole -- Plane of Biological and Higher Cognitive Functions mediated by cognitive resources ~ Vygotsky, 1978



- Consciousness is formed under the influence of knowledge accumulated by society and objectified in the artifacts created by humanity ~ Engeström, 1987
- Mediating Tools and Signs are “crystallized” social experience and cultural knowledge developed through human history. ~ Kaptelinin, 1997
- Designing LO should be --  
**“Design for Consciousness”**







# Some Critical Issues

- Knowledge as capacity
- Cognitive Resources as tools
- A learner and a tool as a joint system
- How to design effective tools for learning?
- Packaging more content in less resources
- How to design for consciousness?
- How to maximize internalization?
- How to maximize externalization?
- How to empowering teachers?



# Historical Perspective

- In our history, with invention of print words, visuals became less important ~ Lester, 2000
- Inner Speech ~ Vygotsky, 1962



# Today...Tomorrow?

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- Interactive
- Visual
- Dynamic
- Conceptual Resources



Courtesy of  
Prof Siu Man Keung,  
Department of Mathematics,  
HKU

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# Classification of Learning Objects

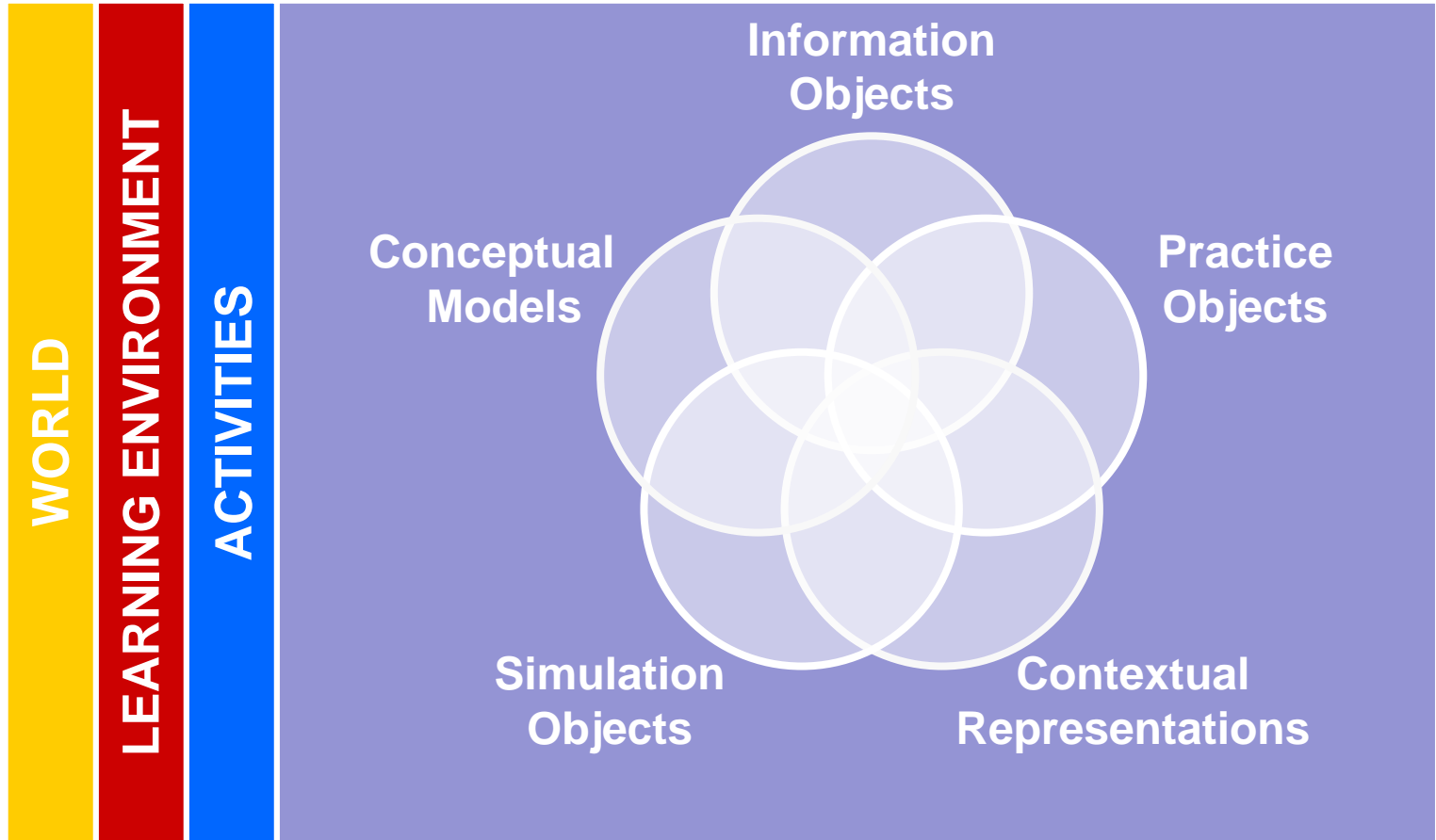
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- **Information Objects** -- represent information and data
- **Conceptual Models** -- represent conceptual resources
- **Contextual Representations** -- represent some environment and allow learners to collect authentic data
- **Simulation Objects** -- represent real system or object
- **Practice Objects** -- allow practice



# LO in a Learning Activity

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# Some Key Issues...

- In any organized learning experience there is an activity (learning task) that engages learners to use tool, interact and produce artifacts
- Activity leads to learning
- What kind of activities are effective for learning?
- How to design activities?
- How to deliver activities and provide support for learners in an e-learning environments?
- How to integrate evaluation with activity?



# *Inquiry as an Activity*

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- Begins with an interesting question that builds on what students already know
- Enables students to construct a “mental model” of an object
- Facilitate students’ division of responsibilities
- Directs students to resources
- Leaves it open to students to get to other resources
- Scaffolds students to collect and organize data and information, search for patterns and relationships, examine and apply theories
- Involve students in presentation and discussion of their reports





# Locating Tools

- Strategy that expects teachers/instructors to develop learning objects is problematic
- Teachers must focus on planning of activities, building of learning environments and facilitation of learning
- We need a library of learning objects
- Collaborative human activity between teachers, subject matter experts and software people is needed to quickly populate library with learning objects



# Designing Learning Objects

- Conducting analysis of information
- Observing real system or object and creating a representation of it
- Identifying source of useful data and creating context for data collection
- Examining own cognitive resources and attempting to externalize them



# About the Presenter

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- *The only limits in the future will be designers' imagination*  
~ Ultimate Machines, Discovery Channel



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