



## CENTER FOR TEXTUAL STUDIES AND DIGITAL HUMANITIES

402 - Instructional Design and e-Learning

Spring Semester 2016

Week 2 - Extra

## human learning and the electronic medium

### intro

- important to consider how people actually learn and study
- games and glitz in media no guarantee of success
- e-Learning design and implementation should therefore consider
  - how the mind learns
  - experimental evidence concerning e-Learning features

## human learning and the electronic medium

how do we learn?

- \* Learning involves strengthening correct responses and weakening incorrect responses
- \* Learning involves adding new information to your memory
- \* Learning involves making sense of the presented material by attending to relevant information, mentally reorganising it, and connecting it with what you already know

## human learning and the electronic medium

how do we learn?

<b>Metaphor of Learning</b>	<b>Learning Is:</b>	<b>Learner Is:</b>	<b>Instructor Is:</b>
Response strengthening	strengthening or weakening of associations	passive recipient of rewards and punishments	dispenser of rewards and punishment
Information acquisition	adding information to memory	passive recipient of information	dispenser of information
Knowledge construction	building a mental representation	active sense maker	cognitive guide

## human learning and the electronic medium

### learning principles and processes - a multimedia lesson part 1

- graphics and words, in printed or spoken form
  - graphics and printed words enter through the eyes
  - spoken words enter our brains through the ears
- material is selected for further processing in the learner's working memory
- in working memory we can mentally organise
  - some of the selected images into a pictorial model
  - some of the selected words into a verbal model
- learner can integrate this new, incoming material with existing knowledge
- three important cognitive processes to consider
  - word and image selection
  - word and image organisation
  - integration

## human learning and the electronic medium - working memory



[Cogmed: What is working memory](#)

## human learning and the electronic medium

learning principles and processes - a multimedia lesson part 2

the learning model reflects four principles, known in cognitive science as:

- dual channels
- limited capacity
- active processing
- transfer

## human learning and the electronic medium

limited resources and learning overload

- demands and issues to consider in cognitive processing
  - extraneous processing
  - essential processing
  - generative processing
- challenge to designers is to create learning environments that
  - minimise extraneous cognitive processing
  - manage essential processing
  - foster generative processing



## 'e-Learning' and its affect on human learning

intro

- design and selection of instruction methods guided by an accurate understanding of how learning actually works
- cognitive learning theory important and useful in this decision
  - explains how mental processes transform information received by eyes and ears
- information methods must therefore guide a learner's transformation of words and pictures in a given lesson
- process relies upon the following
  - selection of important lesson information
  - working memory management for learning
  - integration of auditory and visual information in working and long term memory
  - retrieval of new knowledge and skills from long-term memory

## 'e-Learning' and its affect on human learning

selection of important information

- a person's cognitive system has limited capacity
- many sources of information competing for limited capacity
- learner must select sources that best match their goals
- guided by instructional methods that direct learner's attention
  - prompts, guides...

## 'e-Learning' and its affect on human learning

changing limited capacity in working memory


- free up working memory to replay and rehearse new information
- compare with computer memory, and related performance without free memory
  - learning is naturally reduced and slows down
- a good example of this is mental arithmetic
- difficult to hold even limited amounts of information and process effectively
- burden on working memory is known as 'cognitive load'
- reduction of cognitive load fosters learning by freeing working memory
- 'coherence principle'
- minimalist designs aid greater memory capacity to rehearse a given process...

## 'e-Learning' and its affect on human learning

integration of auditory and visual information

1. collision with a moving particle excites the atom
2. electron jumps to a higher energy level
3. electron falls back to its original energy level, releasing the extra energy in the form of a light photon



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## 'e-Learning' and its affect on human learning

retrieval and transfer of new knowledge and skills

- not sufficient to simply add new knowledge to long-term memory
  - new knowledge needs to be easily retrieved in context
- retrieval of new skills essential for successful transfer of training
- e-Learning necessarily needs to incorporate context to help retrieval
  - examples and practice exercises
  - simple mnemonics as a child
- job learning and training scenarios, role play, troubleshooting exercises...
- link or hook new knowledge to long-term memory

'e-Learning' and its affect on human learning - long-term memory



[Ten Second Tom](#)

## 'e-Learning' and its affect on human learning

a quick summary of learning processes

- learner must focus on key graphics and words in a lesson to select what will be processed
- learner must rehearse this information, and integrate from working to long-term memory
- limited working memory capacity requires lessons to apply cognitive load reduction techniques
- transfer of learning is important to help skill and learning retrieval as required

## 'e-Learning' and research-based evidence

determining good research

"One cannot expect reform efforts in education to have significant effects without research-based knowledge to guide them"

Shavelson, R.J. and Towne, L. 'Scientific research in education'. National Academy Press, 2002

- e-Learning course design based upon research findings
- instructional techniques based on research findings and theory
- summary of e-Learning studies



## 'e-Learning' and research-based evidence

types of research

Research type	Definition	Example
Informal Studies	conclusions based on feedback from and observations of students	revisions to a course based on evaluations during trial lessons and feedback
Controlled Studies	conclusions based on outcome comparisons of randomly assigned participants to groups with different treatments	learning from two identical courses, one with graphics and one without, compared in a laboratory setting
Clinical Trials	conclusions based on outcomes of lessons taken in actual learning settings	e-Learning tools and methods selected based on results from actual course results

- analysis of research methods in education

Phye, G.D., Robinson, D.H., & Levin, J. 'Empirical methods for evaluating educational interventions'. Elsevier, 2005

- proponents of clinical trials note success in medical research as argument for value in educational research

Mosteller, F., & Boruch, R. 'Evidence matters: Randomized trials in education research.' Brookings Institution Press, 2002

## 'e-Learning' and research-based evidence

relevant research in e-Learning

- similarity of the learners in the research study to your own target learners
- conclusions based on an experimental research design
  - subjects randomly assigned to test and control groups
- replication of experimental results
  - conclusions drawn from multiple studies that essentially replicate results
- testing of learning that measures and checks application of new knowledge and skills
  - application instead of simple recall tests

'Review of Education Research' - Journal

'Educational Psychology Review' - Journal

Jonassen, D.H. 'Handbook of Research on Educational Communications and Technology'. 2004

Alexander, P.A., Winne, P. H. 'Handbook of Educational Psychology'. 2006