Information problem solving and mental effort

Saskia Brand-Gruwel
Jimmy Frerejean

Centre for Learning Sciences and Technologies
celstec.org
Information problem solving

- Skills, knowledge and attitude to
  - define the information need;
  - identify sources;
  - judge and select relevant information from the sources;
  - organize the information found;
  - present the information into a coherent product;
  - construct knowledge.

(Brand-Gruwel & Stadtler, 2011; Brand-Gruwel & Gerjets, 2008; Brand-Gruwel, Wopereis, & Vermetten, 2005).
Research in IPS

• The process of IPS.
• Instructional design to foster IPS.
The process of IPS
Unraveling the IPS-process


2005: the Expert-Novice study
Participants: expert-novice study

• Experts:
  • 5 PhD students in the field of Educational Technology in their final year

• Novices:
  • 5 Psychology freshmen from the University of Maastricht
Set up: expert-novice study

Task:
- write in 90 minutes an article for a consumers magazine (± 400 words) about food that is out of date and use MS Word and Internet

Instrument to analyze the thinking aloud protocols:
- for development a inductive-deductive method was used
- three columns were scored simultaneously
  - main skills
  - sub skills
  - regulation
Information Problem Solving
a skill decomposition

- Define information problem
- Internet skills
- Derive search terms
- Judge search results
- Activate prior knowledge
- Clarify task requirements
- Read task
- Concretise problem

- Search information
- Scan site
- Judge scanned info
- Scan information
- Internet skills
- Elaborate on content
- Elaborate on content

- Process information
- Read info
- Elaborate on content
- Judge processed info

- Organise and present information
- Formulate problem
- Outline the product
- Structure the product
- Elaborate on content

- Monitor and steer
- Evaluate process
- Evaluate product

- Orientation on task
- Orientation on time
- Monitoring / steering

Significant difference: experts spend more time on this sub skill
Significant difference: experts do this more often
Process of evaluating sources and information


2009: Students‘ evaluation behavior (secondary education)
Set up: evaluation behavior study

- Participants: 23 students from secondary education

- Tasks: 12 tasks: 4 science / 4 geo. / 4 language
  - example: Young people use MSN and SMS a lot. Does this have an influence on their language proficiency?

- Procedure: each student accomplished 2 tasks while thinking aloud (30 per task)
Results: evaluation behavior study

• Students do not evaluate in a sophisticated way
  – Sources are hardly evaluated on usability and reliability
  – Information is being judged on the connection to the task, the amount of information and the language
Process of evaluation and role of prior knowledge


2011: evaluation behavior of novices and experts in a domain
Set up: evaluation and prior knowledge

• Participants:
  – 20 psychology students (freshmen) (12 men and 8 women; age M = 20.2, SD = 4.07)
  – 17 psychology teachers (University) (7 men and 10 women; age M = 39.5, SD = 12.33)

• Task:
  – Two tasks (reliability of human memory and altruism)
  – Each task had a Google-like result page (SERP) with 17 links
  – select and prioritize information and finally rank the best five sites in 10 minutes
Procedure: evaluation and prior knowledge
Eye-movements
Results: evaluation and prior knowledge

• The domain experts do evaluate the reliability of the sites significantly more often than the novices
• The novices used more superficial criteria for evaluation (statements like: this seems ok, or that may be useful)
• The selected sites of the experts were of a higher quality and a relation with the use of sophisticated criteria

• Data of the eye-movements will be analyzed together with Yvonne Kammerer (KMRC-Tübingen)
Future research: PhD-students

Milou de Smet: Students’ use of electronic outline tools for writing and learning.

Johan van Strien: Multiple document comprehension: impact of epistemic beliefs and attitude on integrating information from different (conflicting) sources

Jaap Walhout (RdMC): Adaptive Instruction to foster students’ information problem solving skills: learning to organize digital information.

Jimmy Frèrejean: The integration of the lifelong learning skill ‘Information problem solving’ into higher education: Effects of different types of feedback and guidance on IPS and mental effort.
Project Jimmy Frerejean: evaluating instruction

Effect of different kind of support (prompts, worked examples or a combination) on

• learning performance
  • Information problem-solving skill
• mental effort
Measuring mental effort

- self-rating scales
- dual-task methodology
- physiological measures
Self-rating scales

pro’s:
• easy to administer
• easy to analyze

cons:
• subjective
• after learning phase
Dual-task methodology

pro’s:
• real-time measure
• objective measurement

cons:
• difficult to design:
  • same modality, but not disruptive
• Is it possible to combine a dual-task approach with eyetracking?
Physiological measures

pro’s:
• real-time measure
• objective measurement

cons:
• difficult to implement (equipment needed)
• difficult to analyze
• disruptive
Eye tracking parameters

- pupil dilation
- fixation duration
- number of fixations
- saccadic amplitude
- blinking
- scanpath (area’s of interest)

Are these parameters (or others) related to mental effort?

Do they correlate with other measures of mental effort?
Contact:

saskia.brand-gruwel@ou.nl
jimmy.frerejean@ou.nl