Learning through constructing pictorial representations

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Overview

- Learning through construction?
  - what is the benefit of construction?
  - what are the demands of construction?
- Learning through constructing pictorial representations?
  - why pictures / diagrams?
  - what is the task?
  - what are the effects?
  - why are there no effects?
  - what may be a solution?

Learning through Construction

- Learning as an active process of construction
  - cognitively and physically active
- Learning is situated
  - authentic learning situations
- Learning takes place in a social context
  - cooperation and communication
- Knowledge as a tool
  - for argumentation
  - for modeling
  - for self-explanation
  - to solve design problems
- Learning as acculturation

the benefits of construction

- deeper understanding
  - elaboration
  - abstraction
  - multiple perspectives – cognitive flexibility
  - transferability
- motivation
- ...

the demands of construction

- dealing with the learning content
- dealing with the learning context
  - construction tools / computer tools
  - communication skills
  - translation
  - ...
- requires sufficient prior knowledge
- requires knowledge about representations
- requires constructing skills

Why pictures?

- expressive
- complete
- consistent
- Inferences
- generative
- ...

Inferences

- complete
- consistent

Why are there no effects?

- requires sufficient prior knowledge
- requires knowledge about representations
- requires constructing skills

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### What is the task?
- Marije:
  - depth
  - breadth
- Wouter:
  - factual
  - inferential
  - structural
- Shaaron:
  - self-explanation
- Erica:
  - to represent/design…
  - space
  - technology (functions)
  - code

### What has been the question?
- Marije: Can diagrams broaden and deepen argumentation?
- Wouter: Is there an additional value of simulating models?
- Shaaron: What are the benefits of drawing self explanation diagrams?
- Erica: Are there different strategies to solve problems with diagrams?
  - Are diagrams effectively used as a “thinking tool”?

### What are the effects?
- no use of pictorial representations?
- non effective use of pictorial representations
  - Marije: no differences (diagram = chat)
  - Wouter: only for prediction
  - Shaaron: no differences
  - Erica: „simple“ pictures

### Why are there no effects? (1)
- task was too difficult?
- lack of prior knowledge
- task processing was too complex?
- capacity interferences between knowledge acquisition and handling of the construction task
- pictorial representations have to be computationally efficient for the specific tasks

### Why are there no effects? (2)
- students are not trained to use diagrams as a thinking tool?
  - lack of strategic skills
    - local strategies
    - surface orientation
    - more guidance is needed
  - interfering variables
    - prior knowledge (with respect to content and to strategies)
    - cognitive skills (e.g. spatial abilities)
    - preferences
    - motivation

### What may be a solution?
- Constructing diagrams as a thinking tool…
  - requires sufficient prior knowledge
  - AT1 studies
  - providing basic content information
  - requires knowledge about representations
  - teaching knowledge about sign systems
  - translation training
  - requires constructing skills
  - training of construction skills
  - more time and guidance for construction
Summary

When we take all these cognitive requirements into account learning through constructing pictorial representations has the potential to deepen understanding and to foster learning.

Thank you for your attention!

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http://www.psych.uni-goettingen.de/abt/4/p_seufert.htm

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