Teaching Techniques

Part V

Didactics course 2011/12

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Learn targets

How to provide students preview of content

How to teach students abstract concepts

How to explain the invisible

How to efficiently make students productive

Providing Preview

Technique 1/4

Advance Organizers bring the essential to the point

Situation:

introducing a new topic

providing preview of content

Problem:

use of technical terms to introduce new topic

preview of content based on technical terms, which are explained latter on

Solution: Advance Organizers (AO):

introduce main ideas, essential concepts

connect with previous knowledge

AO Examples

Start with analogy students are familiar with

Ex. 1.: Routing (of information packages over the Net)

explain how letters are sent

e.g. local mailbox -> distribution center -> airport -> distribution center -> local mailbox

transfer knowledge to the topic of routing

Ex. 2.: Search systems

explain how people search a topic in a book (keyword directory, table of contents)

Build upon existing domain knowledge

Ex. 3.: Relational Databases

Organization of home for cats with tables

Handling Abstraction

Technique 2/4

Representationtrilogy (trias) to grasp abstraction

Situation:

Abstraction/Concepts/Models play an important role in Computer Science

Problem:

Difficult to comprehend abstractions/concepts/models

Solution:

Materialization of abstraction: 3 ways:

1. Enactive representation: experiencing, doing

   semi-enactive: demonstration by teacher

   virtual-enactive: Computer simulation

2. Iconic representation: illustration, visualization

3. Symbolic representation: text, symbols with semantics

Explaining the Invisible

Technique 3/4

Visualizations make invisible things visible

Situation:

- Digital world consists of states and signals

Problem:

- Data streams, events, computation are typically not observable
- Sequence of 0s and 1s provides no semantic
- Digital devices are dynamic systems

Solution:

- Visualization of states
- Simulation

Tips

- Computers provide tools for visualizing states and dynamic behavior
  - Monitoring tools
  - Source code viewer of Web browser
- Existing visualization/simulations on the Internet
  - www.sigcse.org/topics
- Do it yourself
  - Return on Investment (ROI)

Transfering Knowledge

Technique 4/4

First read then write

Situation:

- Students are taught elements/syntax/vocabulary

Problem:

- Students don't know how to apply these information
  - Information transfer. Not knowledge transfer
- Trial & Error behavior of students -> ineffective

Solution:

- Analyze existing programs (program comprehension)
- Analyze how things are used
  - Students gain knowledge from reading/analyzing

Conclusion

- How to provide students preview of content
  - **Advance Organizers**
- How to teach students abstract concepts
  - **Visualization**
- How to explain the invisible
  - **Simulation**
- How to efficiently make students productive (knowledge transfer)
  - **Understand before doing**