Navigating a robot through a maze you cannot see: how young blind learners approach the computational concept of abstraction

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Inclusivity in programming education

Participation all learners

Use of computer and tools

Motivation and involvement

Conceptual thinking
Learners with visual impairments
Accessibility and tools
Accessibility and learning concepts through tools
Abstract concepts and mental modeling

- Specificities in mental modeling and spatial navigation
- Teaching abstract concepts
Abstraction

• Various levels in viewing situation

• Model of four layers of abstraction
  - Concrete behaviors approach to programming task

• Four layers
  - Problem
  - Design
  - Code
  - Execution

• Insight into approach and experience concept abstraction
Assessing abstraction in VI learners
Assignment set up

• Pairs of learners
  - Low vision and blind

• Assessing
  - Concrete behaviors engaging in layers
  - Pattern of switching between layers
Pattern young blind and low vision learner
Pattern of abstraction levels
Pattern of abstraction levels

• Problem and design practices
• Making a plan
• Discussing, pointing, feeling
Pattern of abstraction levels

• Quickly switching between design and coding
• Think of step – code step – think of step – code step – think of step – code step
• Discussing, feeling along, placing bot
Pattern of abstraction levels

- After executing program: back to problem, design, code
- Debugging
Pattern two older blind learners
Pattern of abstraction levels

- Designing and coding part of program - testing
Overall patterns

• Deliberate switching between layers
  - Iterative processes
  - Redesigning and debugging

• Processes similar to sighted learners

• Behaviors both similar and alternative

• Alternative
  - Manual involvement with bot “Let’s put the bot on the place where it would be next”
  - Physical enactment “Look, look, I take a step, turn, step, step, turn, step, turn”.
Embodiment

• “Look, look, I take a step, turn, step, step, turn, step, turn”.

• Embodied cognition as educational strategy

• Mental processes mediated by body-based systems

Inclusive education

• Conceptual level
• Inclusion for all learners and embodiment

• “Wow yes it made it!”
• “Let’s now make a parking game for the bot!”
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