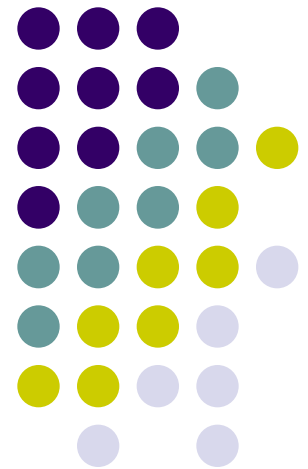


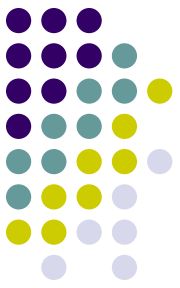
A Metacognitive Approach to Support Heuristic Solution of Mathematical Problems

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Heuristics in the Singapore Mathematics Syllabus (upper primary and lower secondary)



1. Act it out
2. Use a diagram/model
3. Use guess-and-check
4. Make a systematic list
5. Look for patterns
6. Work backwards
7. Use before-after concept
8. Make suppositions
9. Restate the problem in another way
10. Simplify the problem
11. Solve part of the problem
12. Think of a related problem
13. Use equations
(Heuristics 12 and 13 are not in the upper primary syllabus.)



Questions

- What are problem solving heuristics?
- Why, how, and when are they used to solve problems?
- How are the thirteen heuristics similar and/or different from each others?

Problem Solving Heuristics



- Rules of thumb for making progress on difficult problems (Polya, 1973).
- General suggestions on strategy that are designed to help when we solve problems (Schoenfeld, 1985).
- Methods and strategies that can be helpful in problem solving. (Bruner, 1960)
- Non-rigorous methods of achieving solutions to problems.



Classification of heuristics

- Representation heuristics
 - Act it out, Draw a diagram/model, Use equations
- Simplification heuristics
 - Restate the problem in another way, Make suppositions, Solve part of the problem, Look for patterns
- Pathway heuristics
 - Work backwards, Use before-after concept
- Generic heuristics
 - Think of a related problem, Use guess-and-check, Make a systematic list



Example

Mary has six apples.

Peter has two apples.

How many apples does Mary need to give Peter so that the amount of apples she has is twice the amount of apples Peter has?

Representation



- Heuristics:
 - Act it out
 - Draw a diagram/model
 - Use equations
- Bruner's knowledge representation (1967)
 - Enactive representation
 - Iconic representation
 - Symbolic representation

Simplification



- Simplification heuristics
 - Restate the problem in another way
 - Make suppositions
 - Solve part of the problem
 - Look for patterns
- Perspective and subjective



Pathway

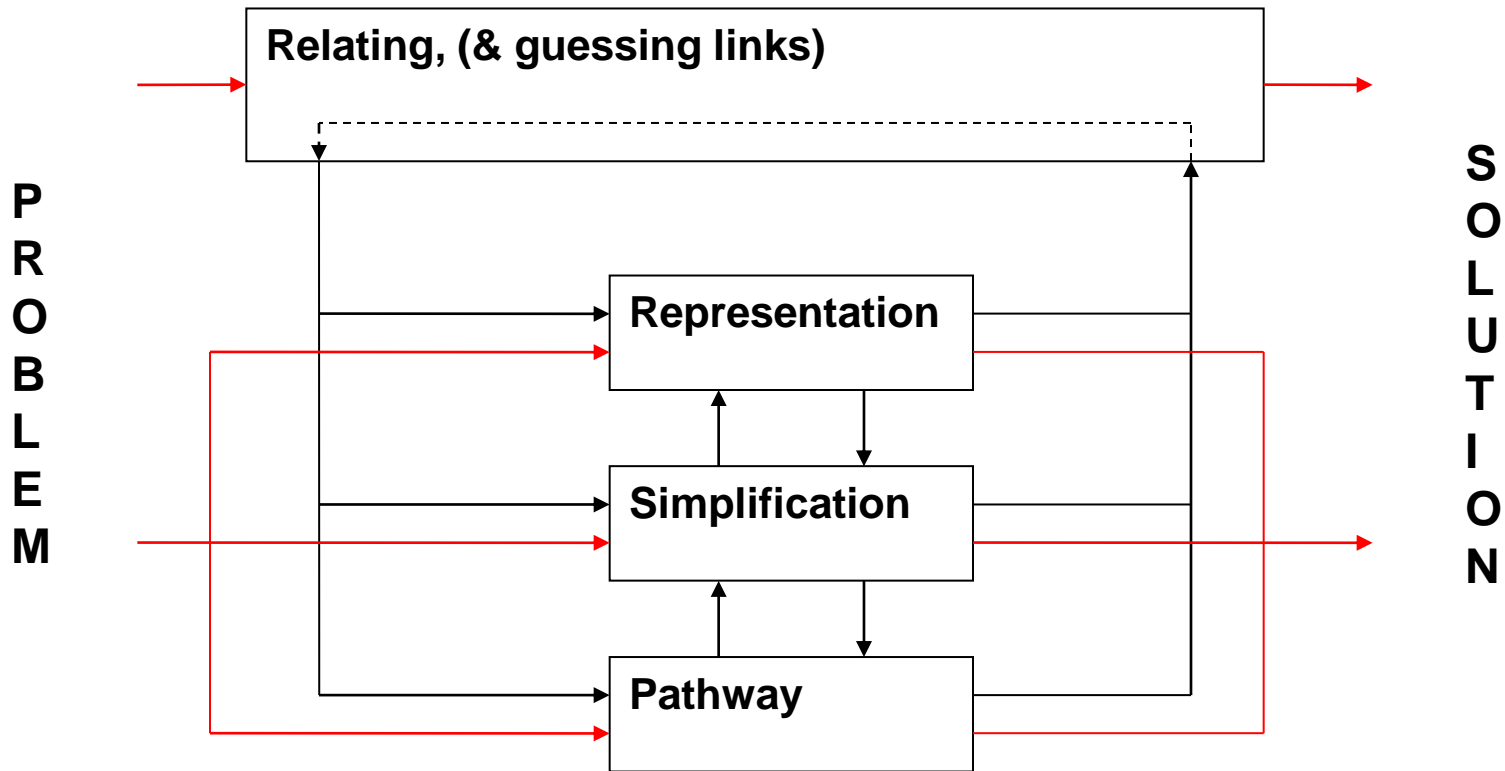
- Pathway heuristics
 - Work forwards
 - Work backwards
 - Use before-after concept
- Different starting points require different approaches to solve problems.



Relating, guessing

- Generic heuristics:
 - Think of a related problem
 - Use guess-and-check
 - Make a systematic list
- Do not try to search for solutions, instead try to “bring in solutions” to fit the problem.

Model for problem solving in mathematics



Thank you

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