



Conditions for successful learning of programming skills

Jaana Holvikivi, DSc.
School of ICT

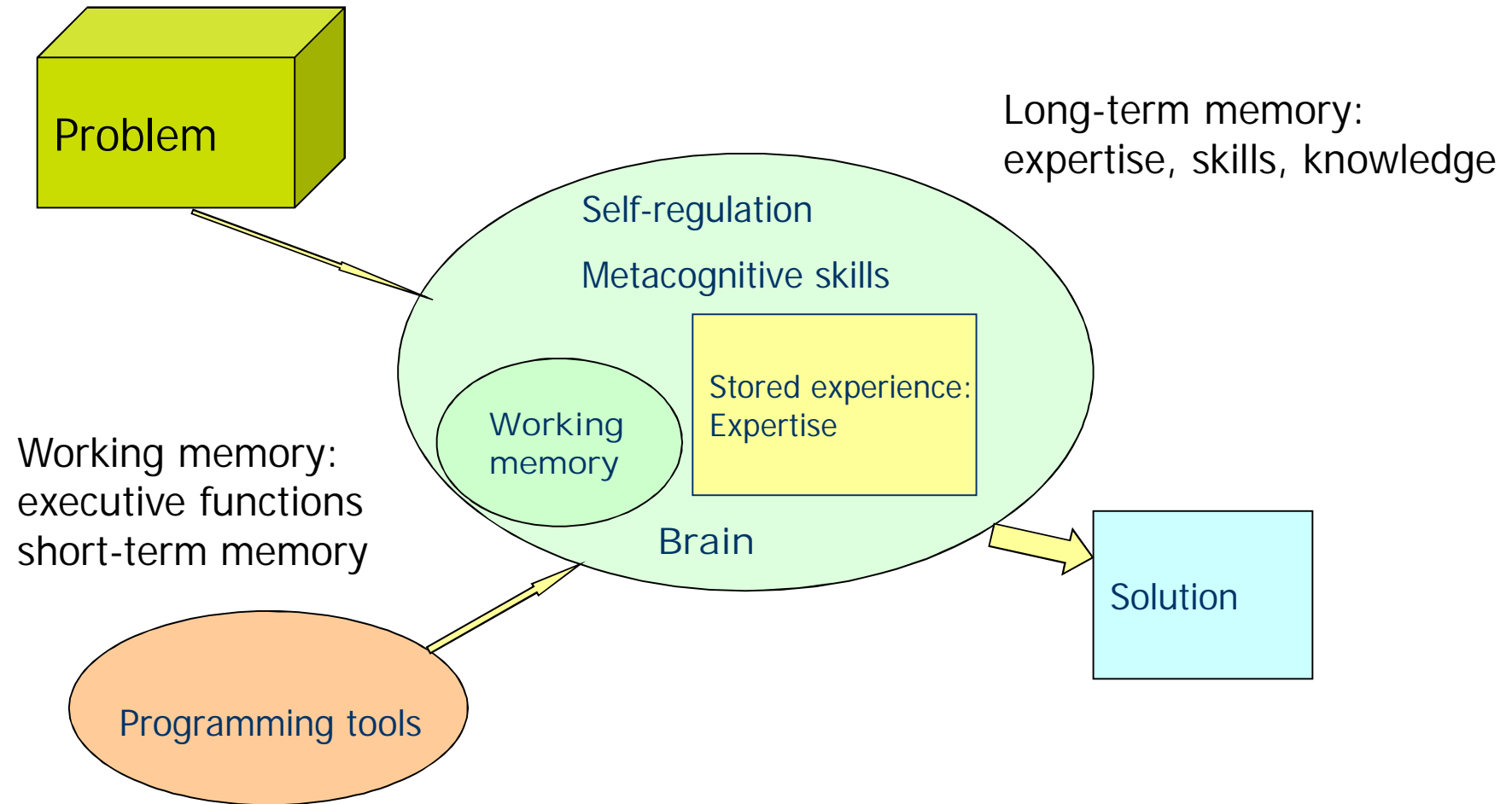


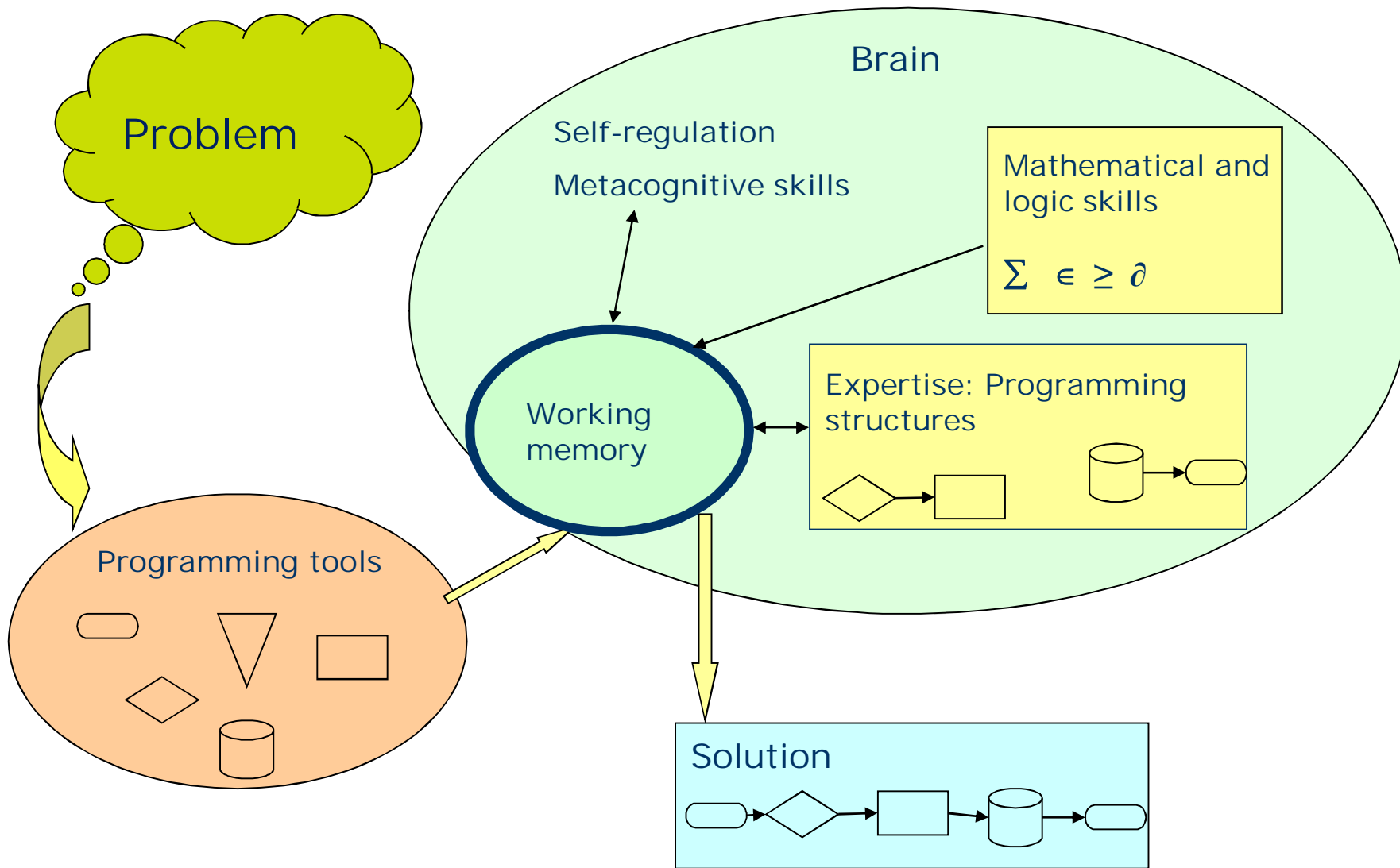
Why do students dislike programming?

- Many students
 - dislike programming, want to avoid it
 - find it hard to learn
- Is it really difficult?
 - NO!
- Is the problem in
 - abilities? no
 - motivation? yes
 - required skills? maybe

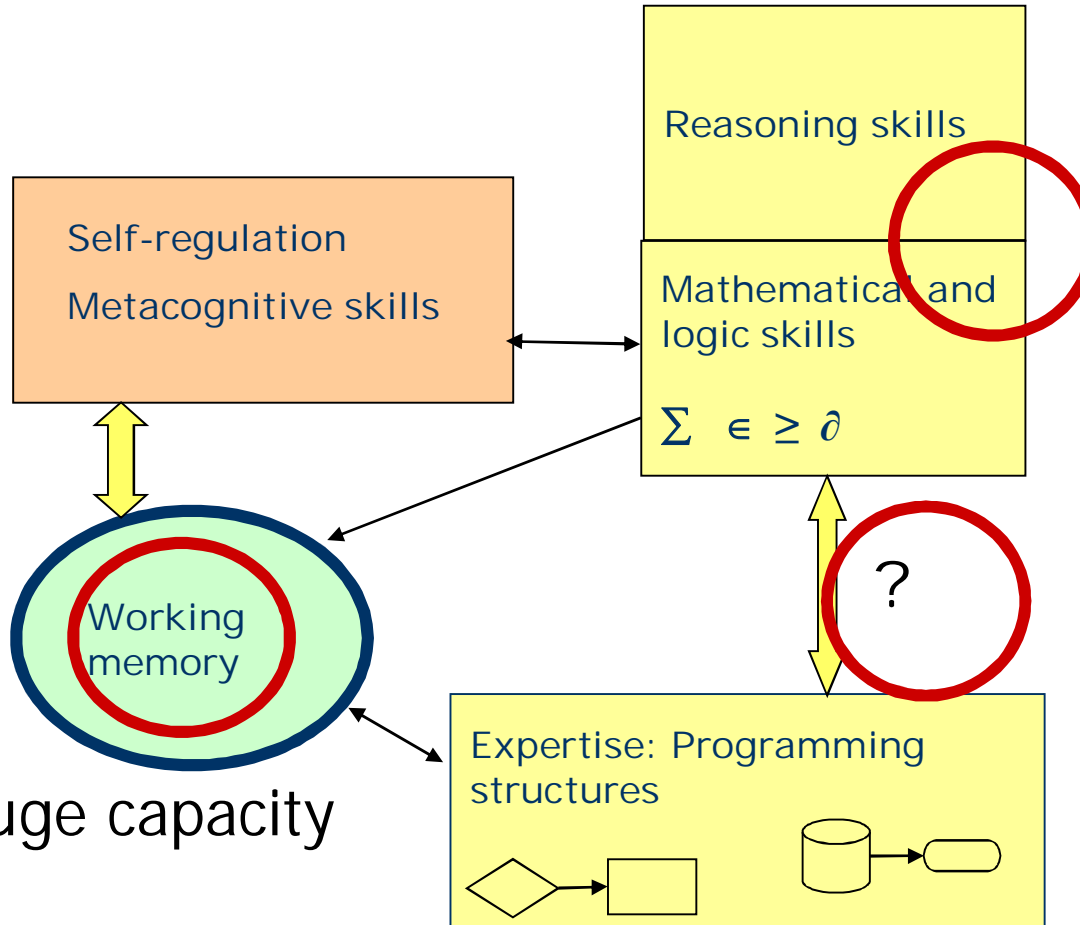


What does the brain do in programming?





Background skills



The brain has a huge capacity

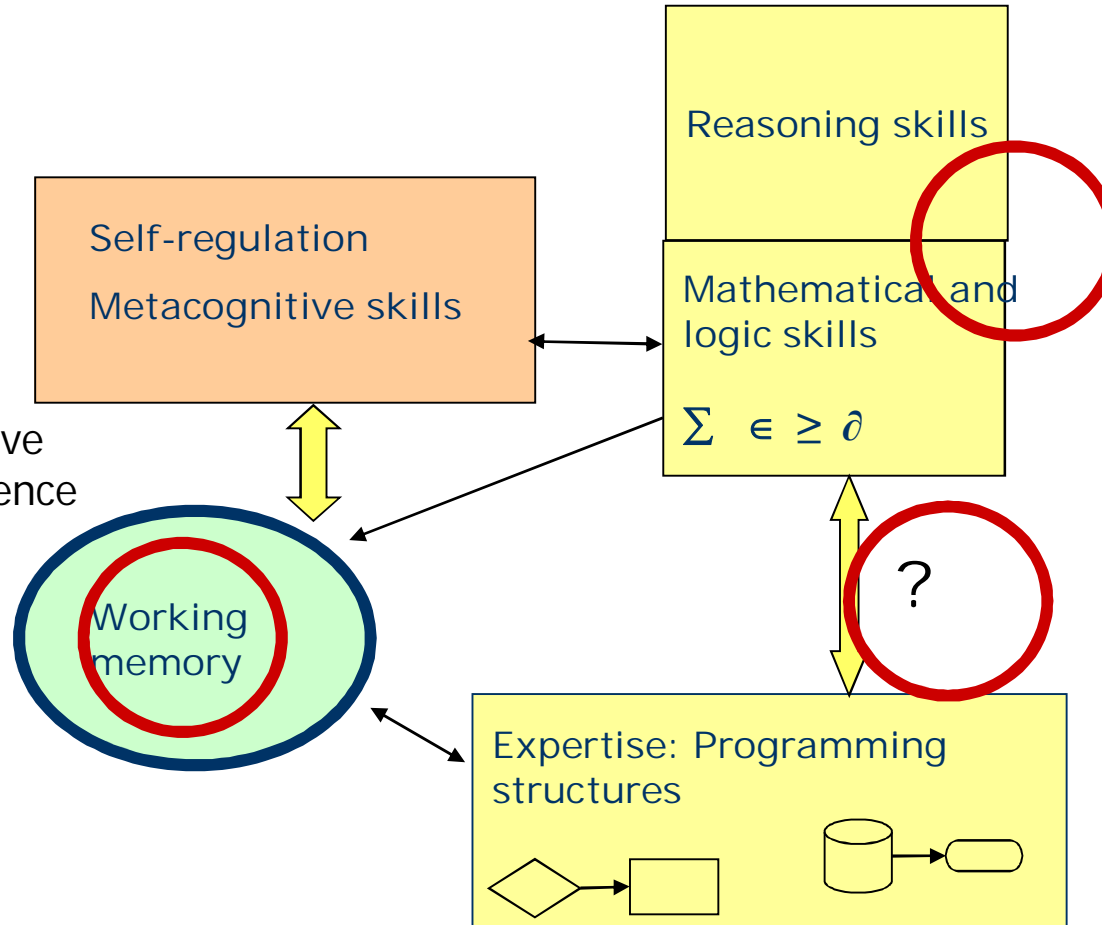
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the working memory has a tiny capacity



Background skills

Self-regulation and metacognitive skills have been shown to influence programming ability and learning

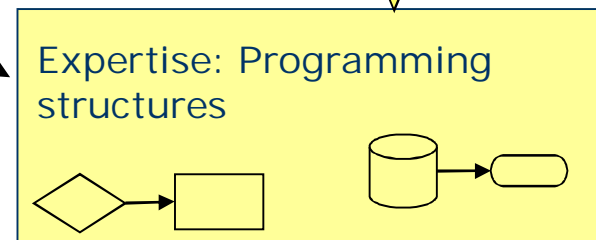
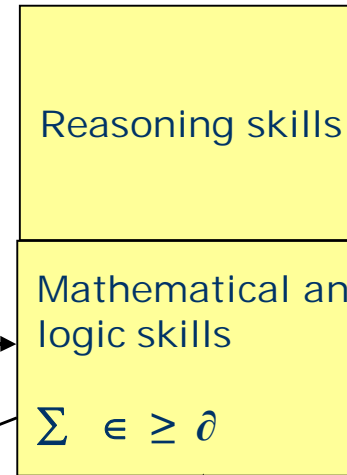
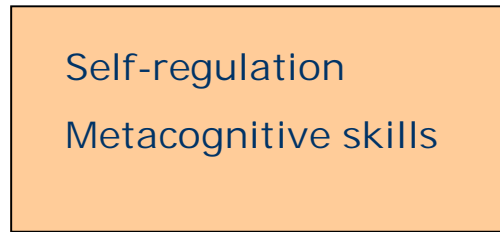
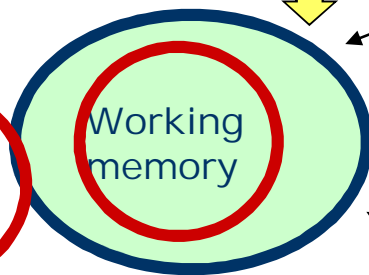
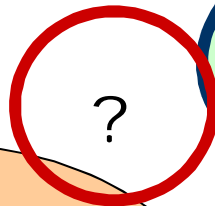
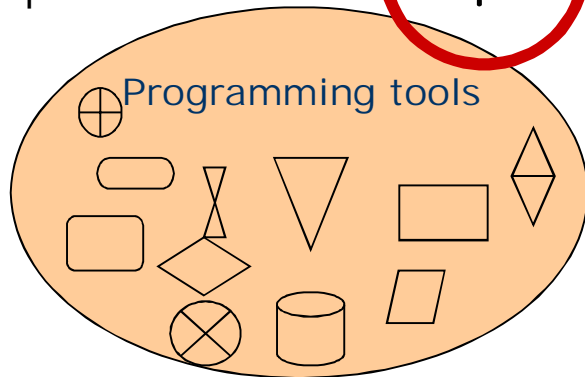


Unconscious processes
Awareness

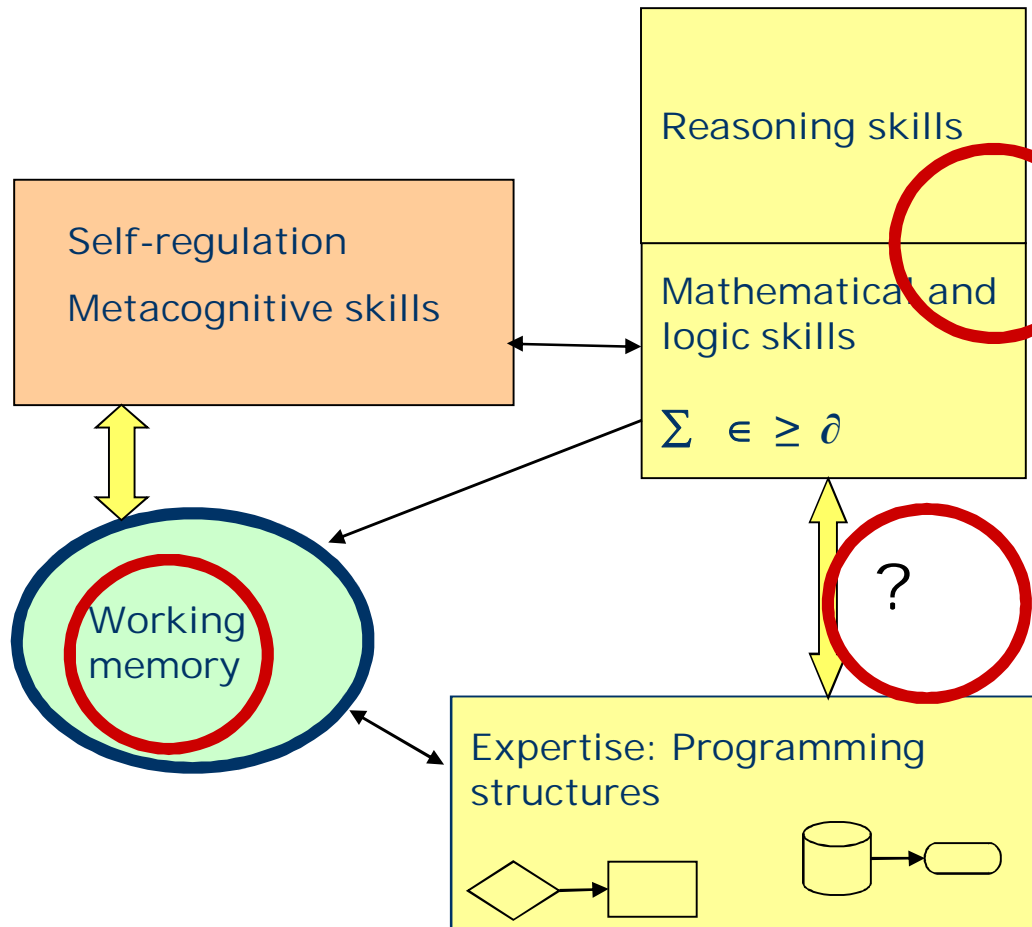


Background skills

Use of tools in writing and thinking;
Somatosensory experience



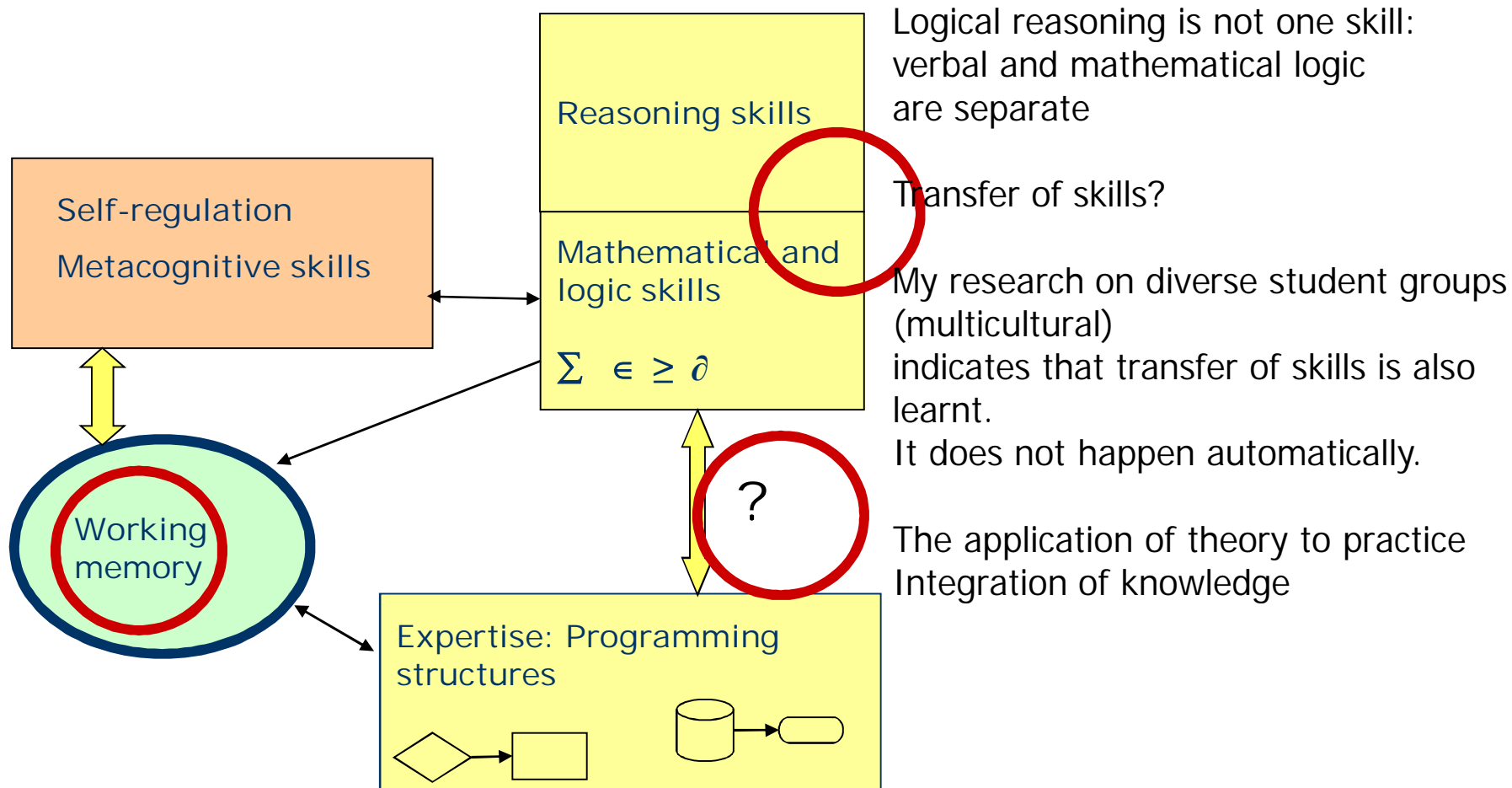
Background skills



Is programming dependent on logical reasoning skills and mathematics?
Transfer of skills?



Background skills



Inconsistency in reasoning

Number of correct answers in a test in Boolean and verbal logic

Population: mixed nationalities and varied levels of knowledge, 45 respondents (Men 40/ Women 5)

Boolean AND and OR correct	31	69%
Syllogisms: 4 correct	6	13%
3 correct	11	24%
0, 1 or 2 correct	28	62%



Example of a syllogism

1B GIVEN: If it is raining then the roof is wet.

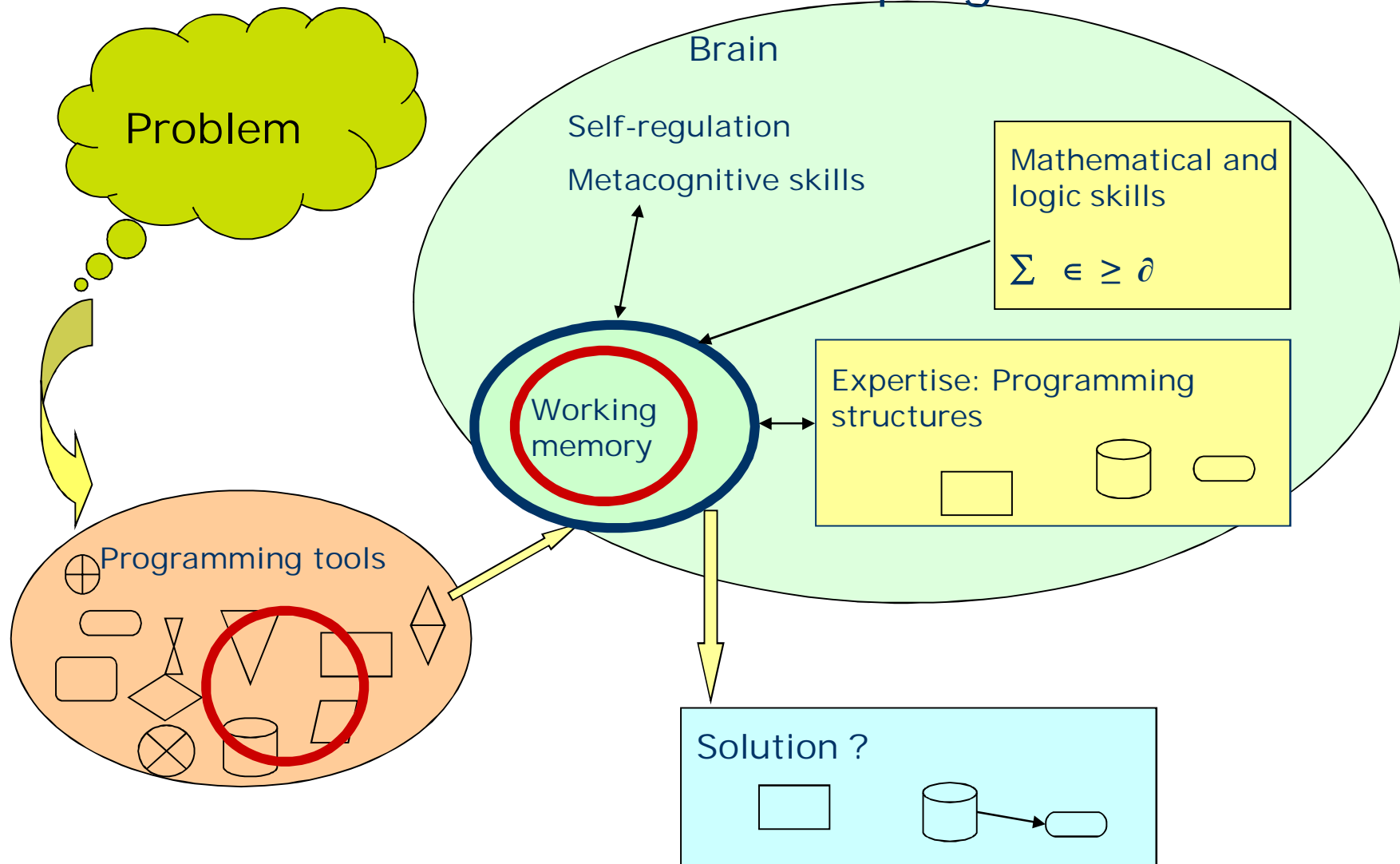
SUPPOSE: The roof is wet.

THEN:

- (a) It must be the case that it is raining.
- (b) Maybe it is raining and maybe it isn't.
- (c) It must be the case that it is not raining.



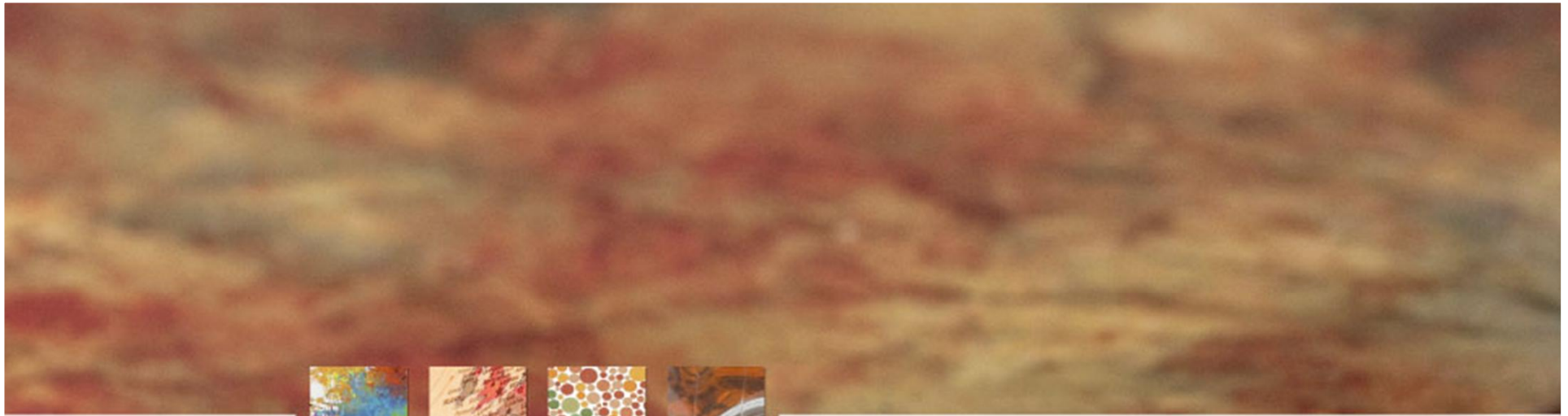
Novice programmer



Conclusions

- The traditional knowledge of introducing an easy language first has once again found support
- Students must have certain basic abilities when they start learning programming: understanding of formal systems & self-monitoring
- Accumulation of programming expertise is a continuous process of constructing new, useful patterns in the mind to be called on demand.
 - Practice
 - Applying theory to practice





<http://www.metropolia.fi/en>
<http://users.metropolia.fi/~jaanah>
jaana.holvikivi@metropolia.fi

