



Can we teach transferable knowledge? An adversarial collaboration

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The ASTRAPI Project

4 years project funded by the French National Research Agency :



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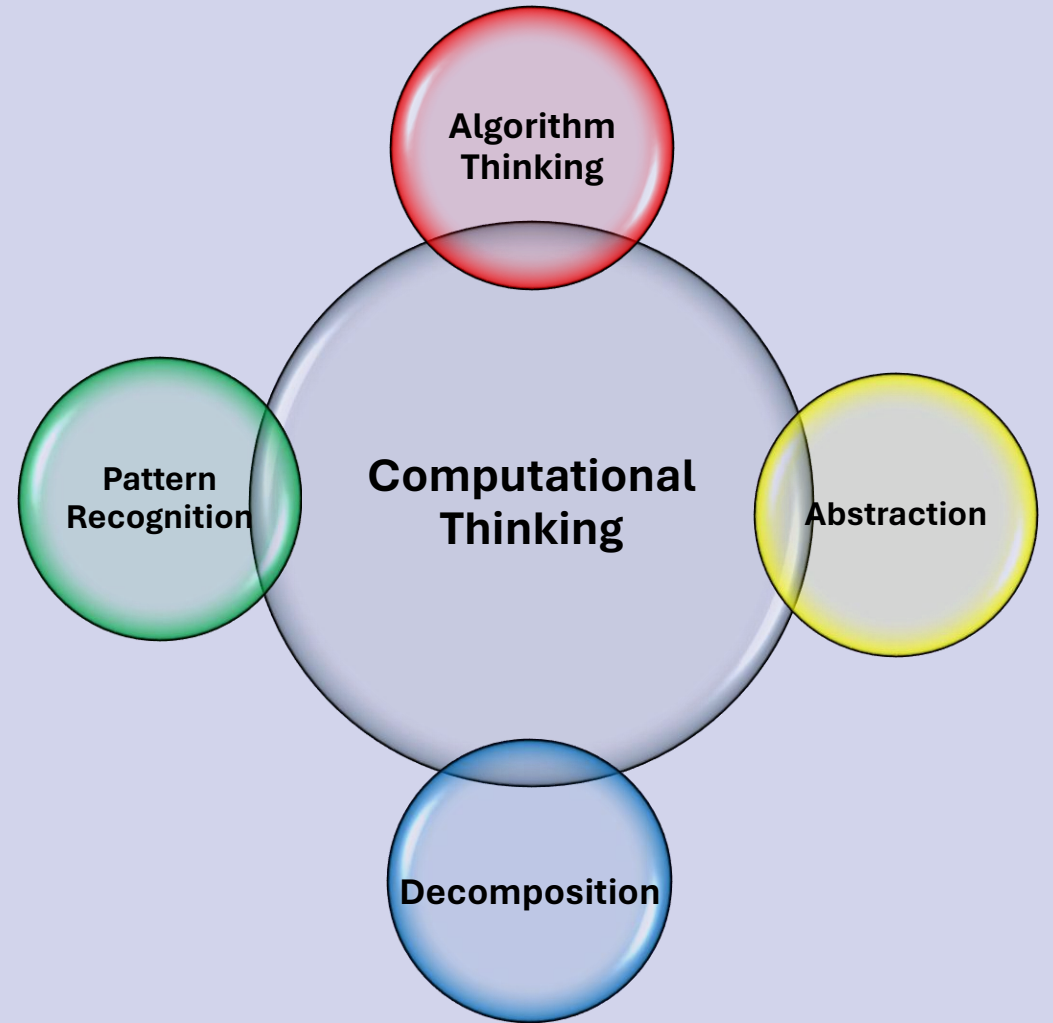
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Computational Thinking (CT)

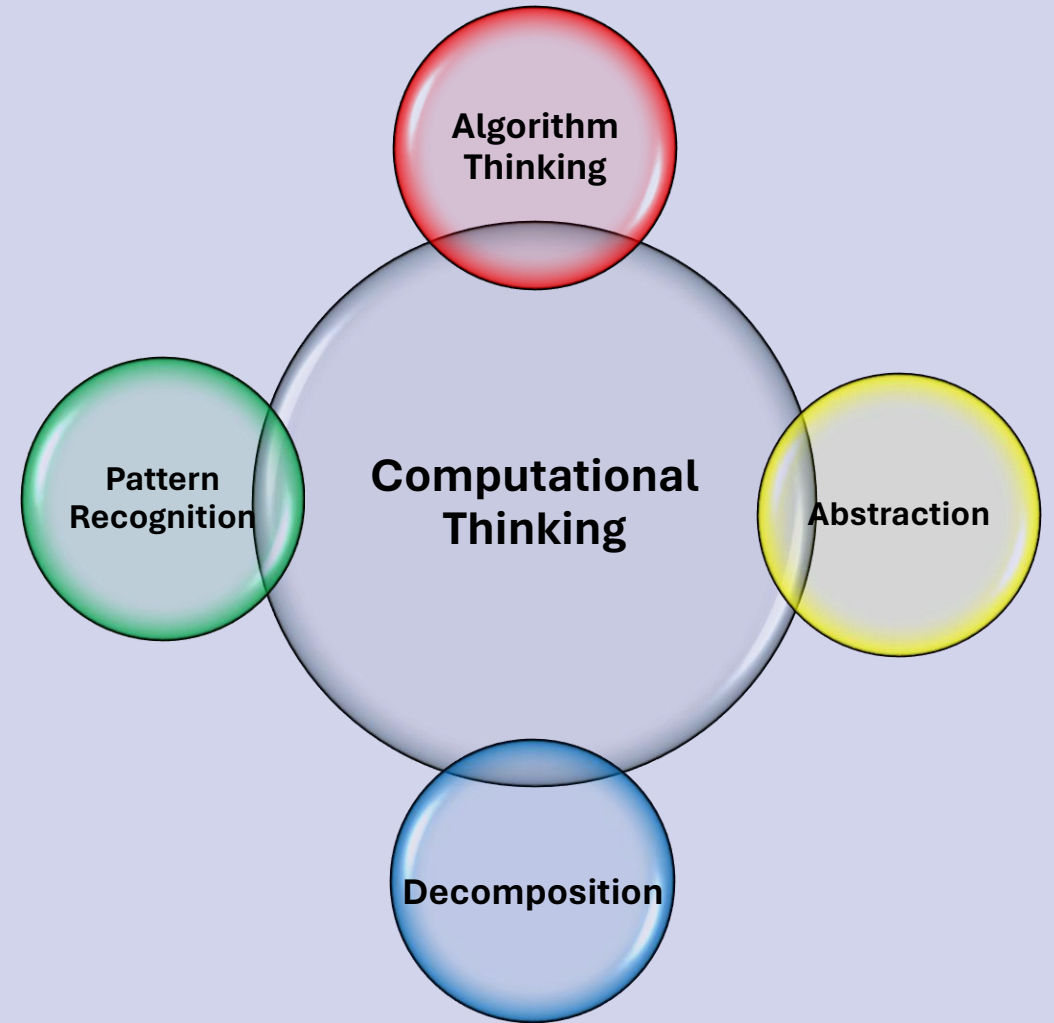
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(*Barr, Harrison, & Conery, 2011; Bocconi et al., 2016*)



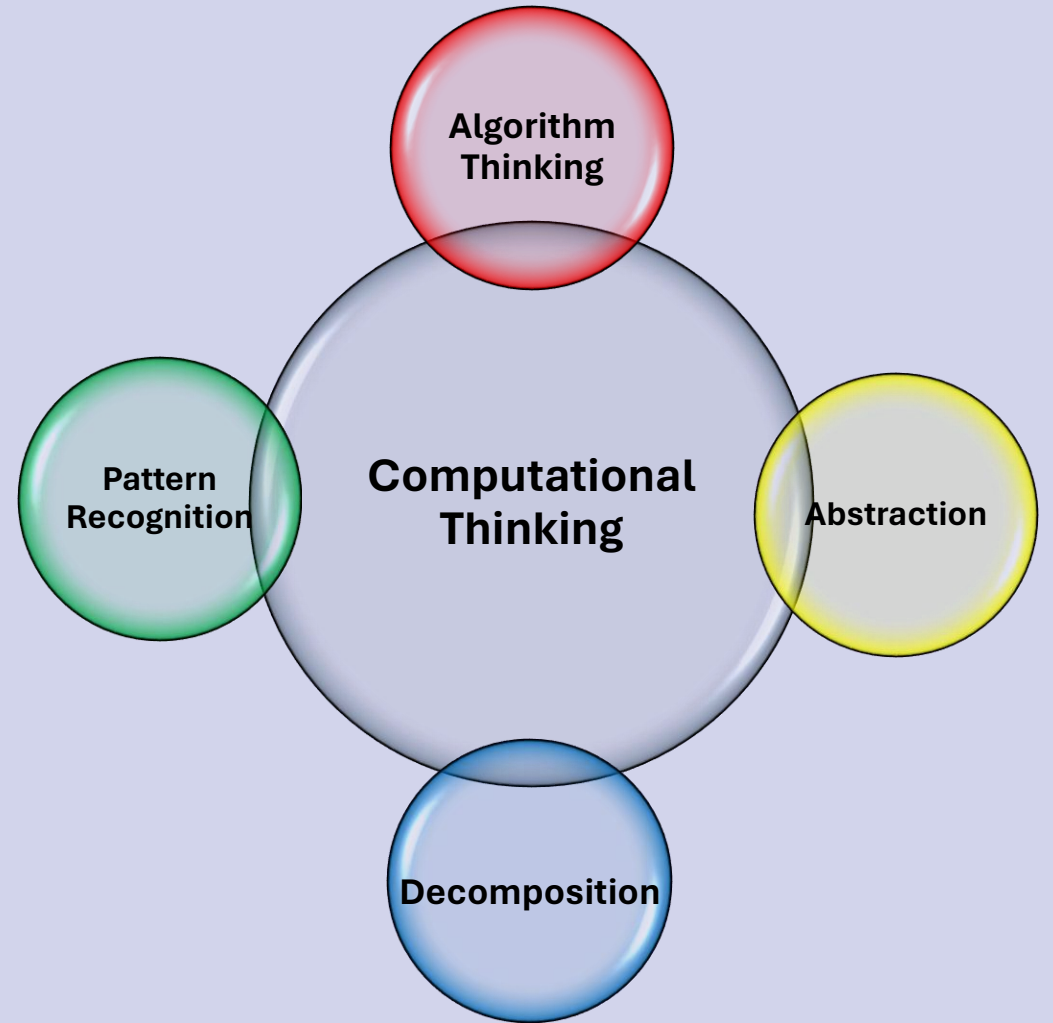
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Considered as a general skill –

Can we transfer CT knowledge to other disciplines or learning contexts?



Computational Thinking (CT) a set of skills

Transfer of Knowledge

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 - ❖ Far Transfer: dissimilar contexts
- How far can I transfer knowledge that I learned?

Adversarial collaboration

Analogy Theory

- Analogical comparison
- Foster abstraction
- Far transfer

Hofstadter & Sander (2013)

Cognitive Load Theory

- Knowledge specificity
- Transfer only within the same context
- Near transfer

Tricot & Sweller (2014)

Rationale

Objective : Investigate Computational Thinking and its overall impact in education.

How far can I transfer the Computational Thinking knowledge?

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Can we foster (near and/or far) transfer through teaching?

The Present Experiment

Teaching problem-solving in 5th grades classrooms based on algorithmic thinking concept.

Example:



To unlock his lock, Marius had to create a two-digit code. The digits can be 0, 1, 2 and/or 3. Unfortunately, Marius has forgotten his code and can no longer open his lock. Help Marius to find his code, which codes he needs to try to make sure he finds the one that will open his lock?

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Solution :

0 - 0	1 - 0	2 - 0	3 - 0
0 - 1	1 - 1	2 - 1	3 - 1
0 - 2	1 - 2	2 - 2	3 - 2
0 - 3	1 - 3	2 - 3	3 - 3

Experimental Design

6 Classrooms for WE and WE + A and 3 for the PS Condition.

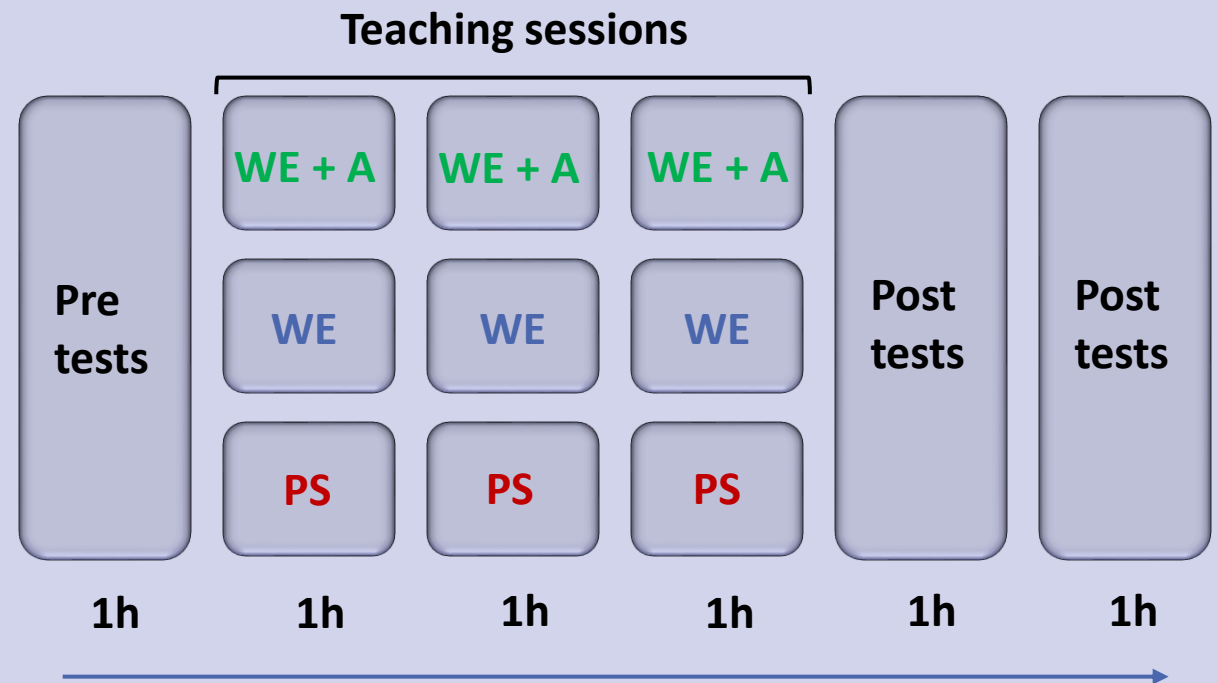
6 Sessions over 6 weeks

3 Teaching conditions:

WE + A = Worked-examples + Analogical comparison

WE = Worked-examples

PS = Problem-solving



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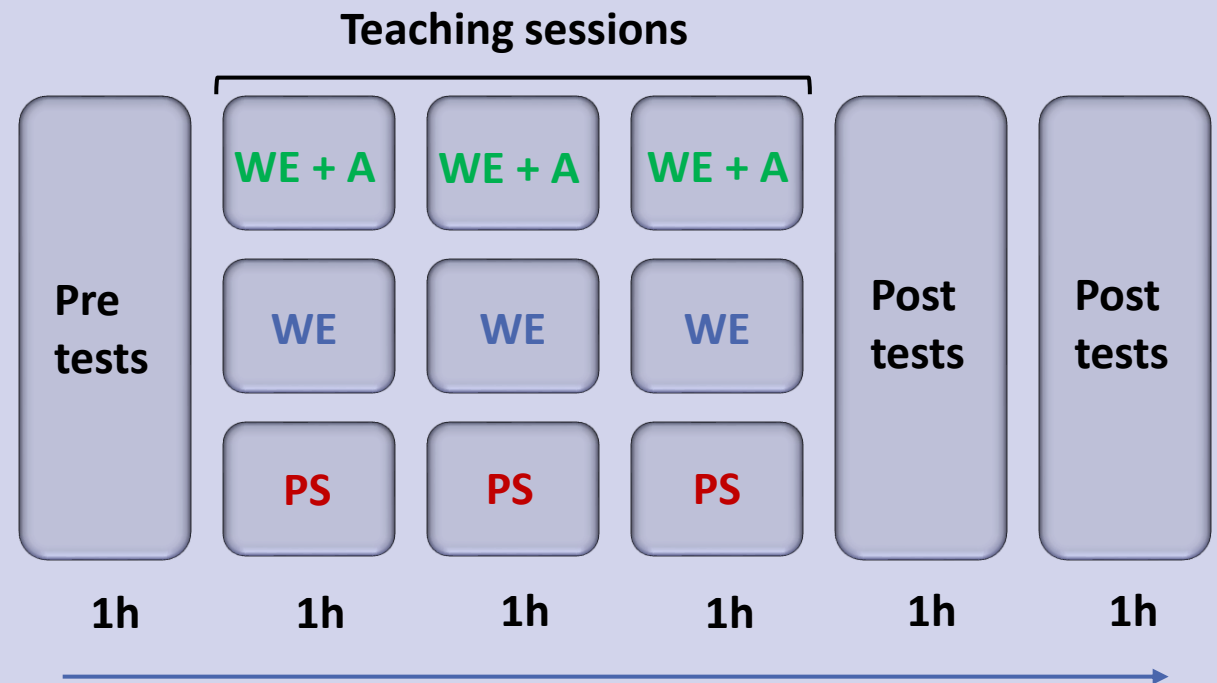
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Posttest = **Near** and **far** transfer problems

Dependent Variable = **Strategy_Score**

Predictions

DV : Strategy Score

Cognitive Load Theory

Near Transfer Problems

$$\text{WE} > \text{WE} + \text{A} > \text{PS}$$

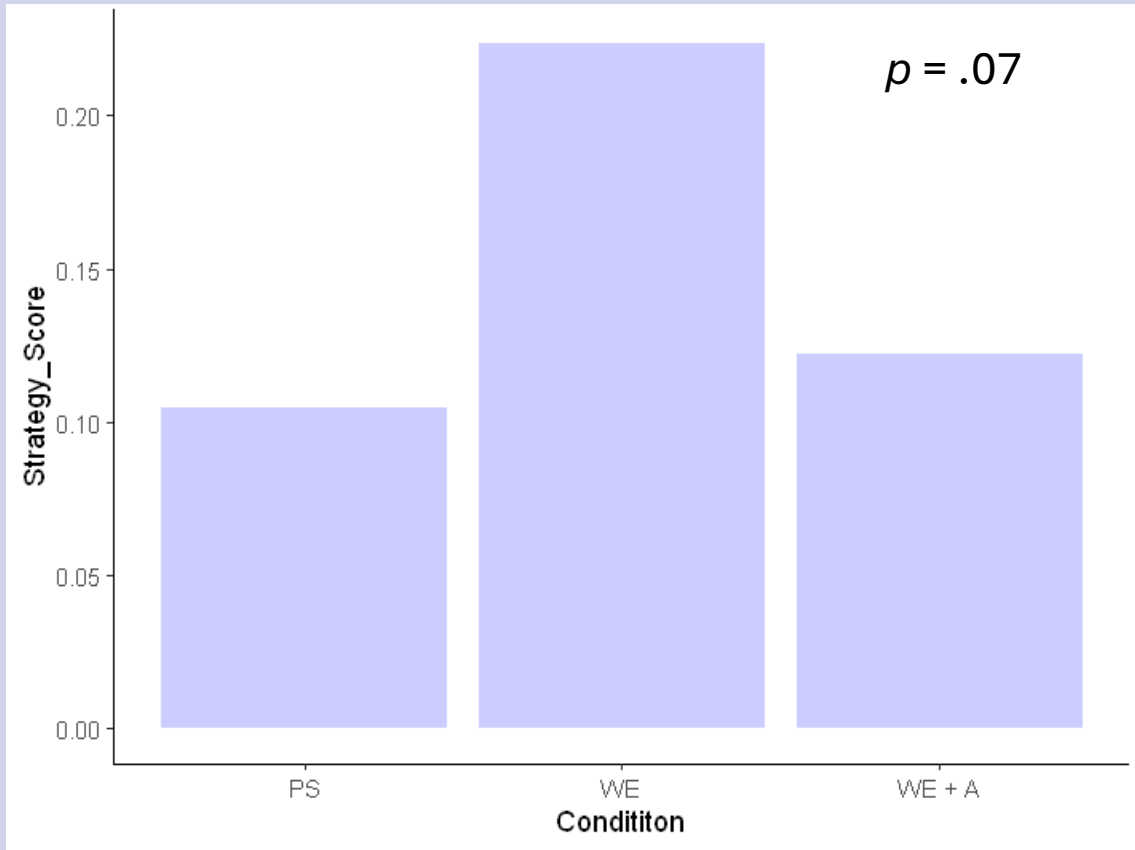
Analogy Theory

Far Transfer Problems

$$\text{WE} + \text{A} > \text{WE} > \text{PS}$$

Results

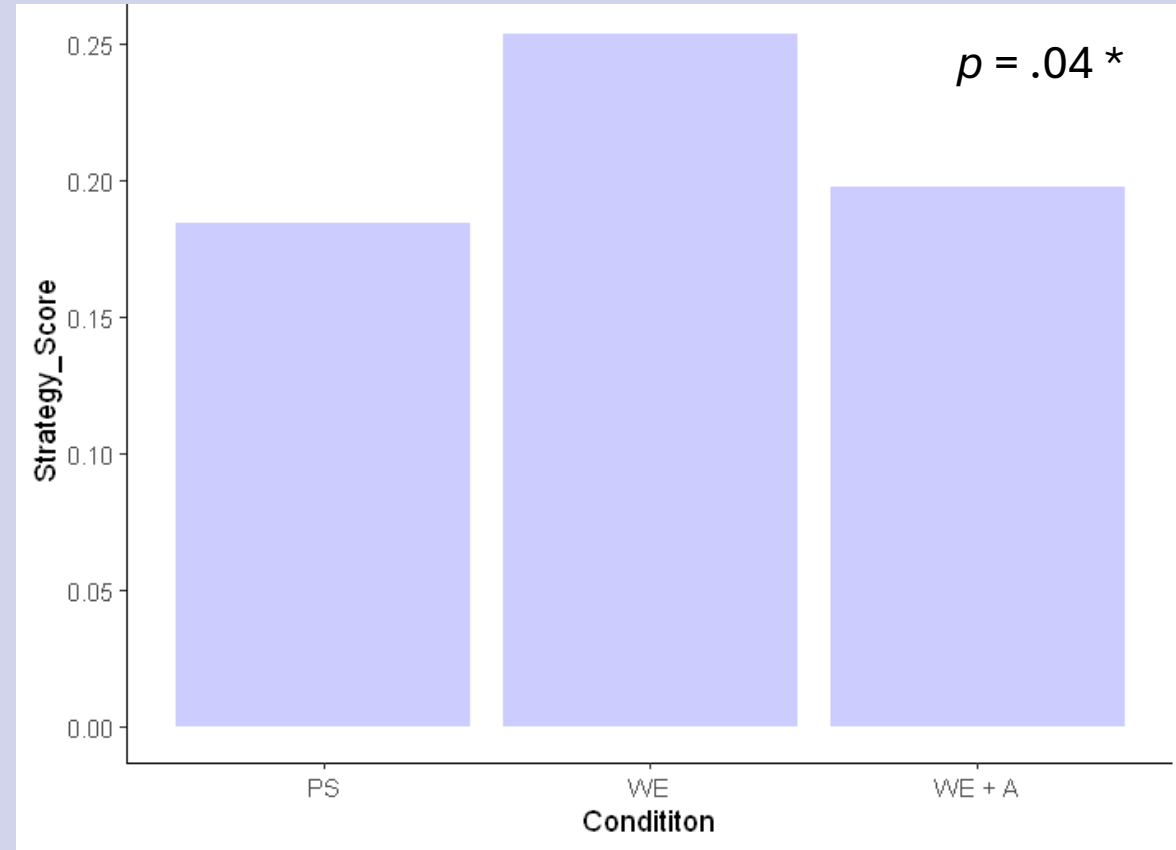
Near Transfer Problems



Condition (N)	<i>M</i>	<i>SD</i>
WE + A (N = 91)	0.12	0.11
WE (N = 88)	0.22	0.26
PS (N = 33)	0.1	0.09

Table 1. Strategy_Score from 0 to 1 for Near transfer Problems - Mean and SD per condition.

Far Transfer Problems



Condition (N)	<i>M</i>	<i>SD</i>
WE + A (N = 92)	0.18	0.24
WE (N = 88)	0.25	0.2
PS (N = 34)	0.2	0.21

Table 2. Strategy_Score from 0 to 1 for Far transfer Problems - Mean and SD per condition.

Discussion

- WE:
 - useful teaching method to promote near transfer AND far transfer?

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- WE > PS

Conclusion

- New experiments
 - Refine the material
 - Increase the statistical power
 - Explore other populations

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- New experiments
 - Refine the material
 - Increase the statistical power
 - Explore other populations
- Can we teach general abilities?
- Shed light on relevant teaching types to enhance transfer

Thank you for your attention!

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