



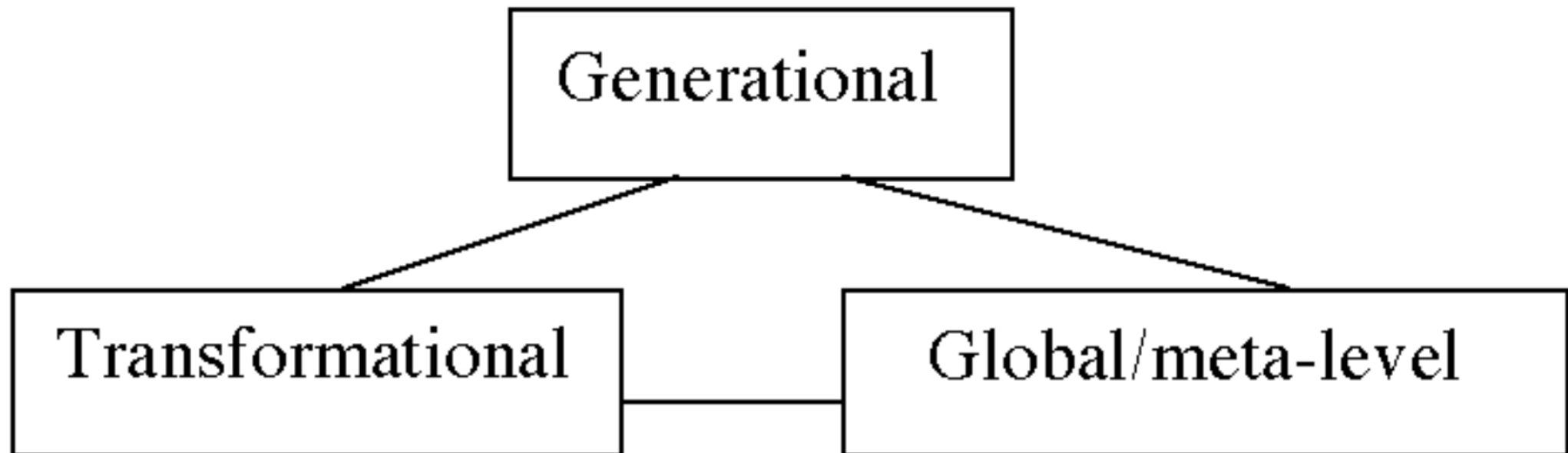
# *Advise-me Competencies and Tasks*

Paul Drijvers

# Topic

- **Domains: Number and Relationship**
- **Core Subject Taxonomy: 1.2 Arithmetic and 3.1 Algebra**
- **12-15 year old students**
- **Foci:**
  - **set up algebraic expressions and simplify them**
  - **set up equations and inequalities and solve them.**

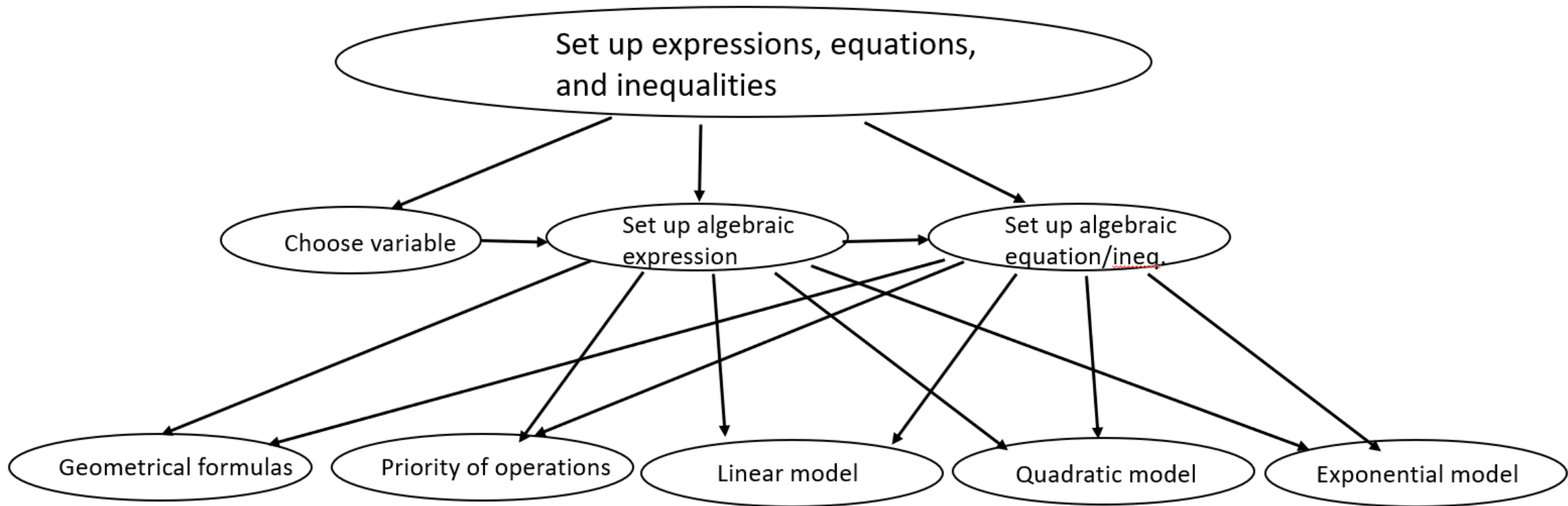
# Components of algebraic activity in school: Kieran's (2006) GTG model



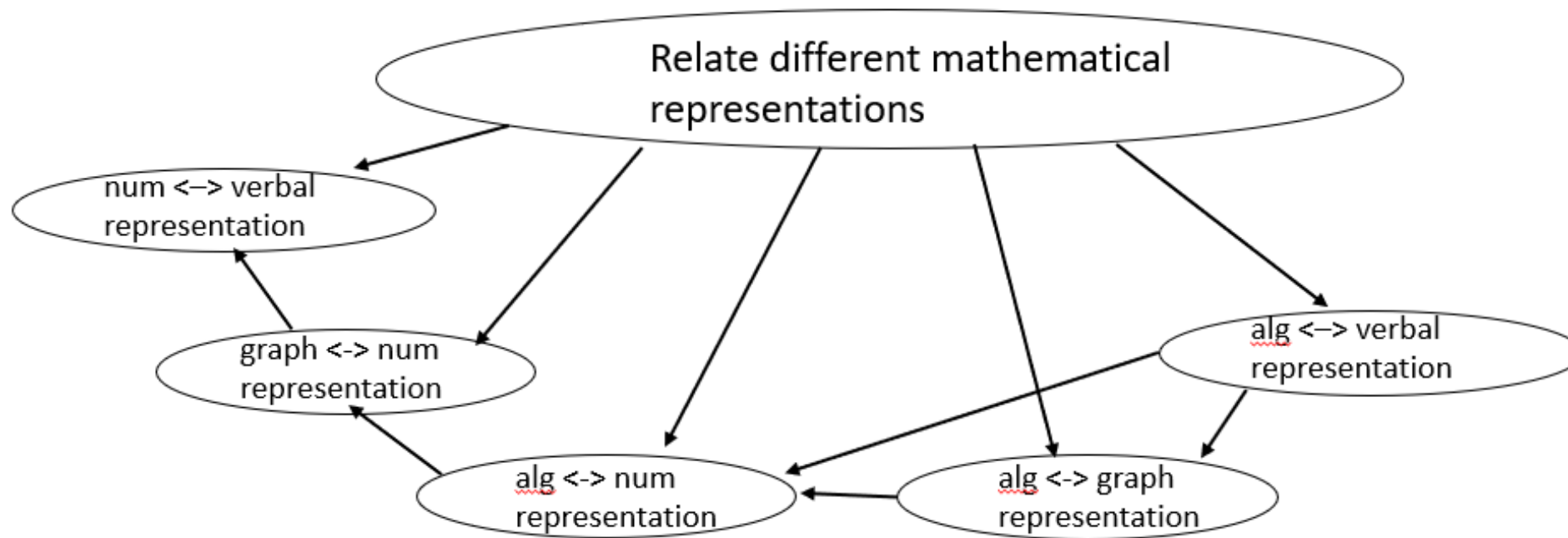
# Competencies

- R1: Set up expressions, equations, and inequalities**
- R2: Relate different mathematical representations**
- R3: Simplify, expand, and factor algebraic expressions and solve equations and inequalities**

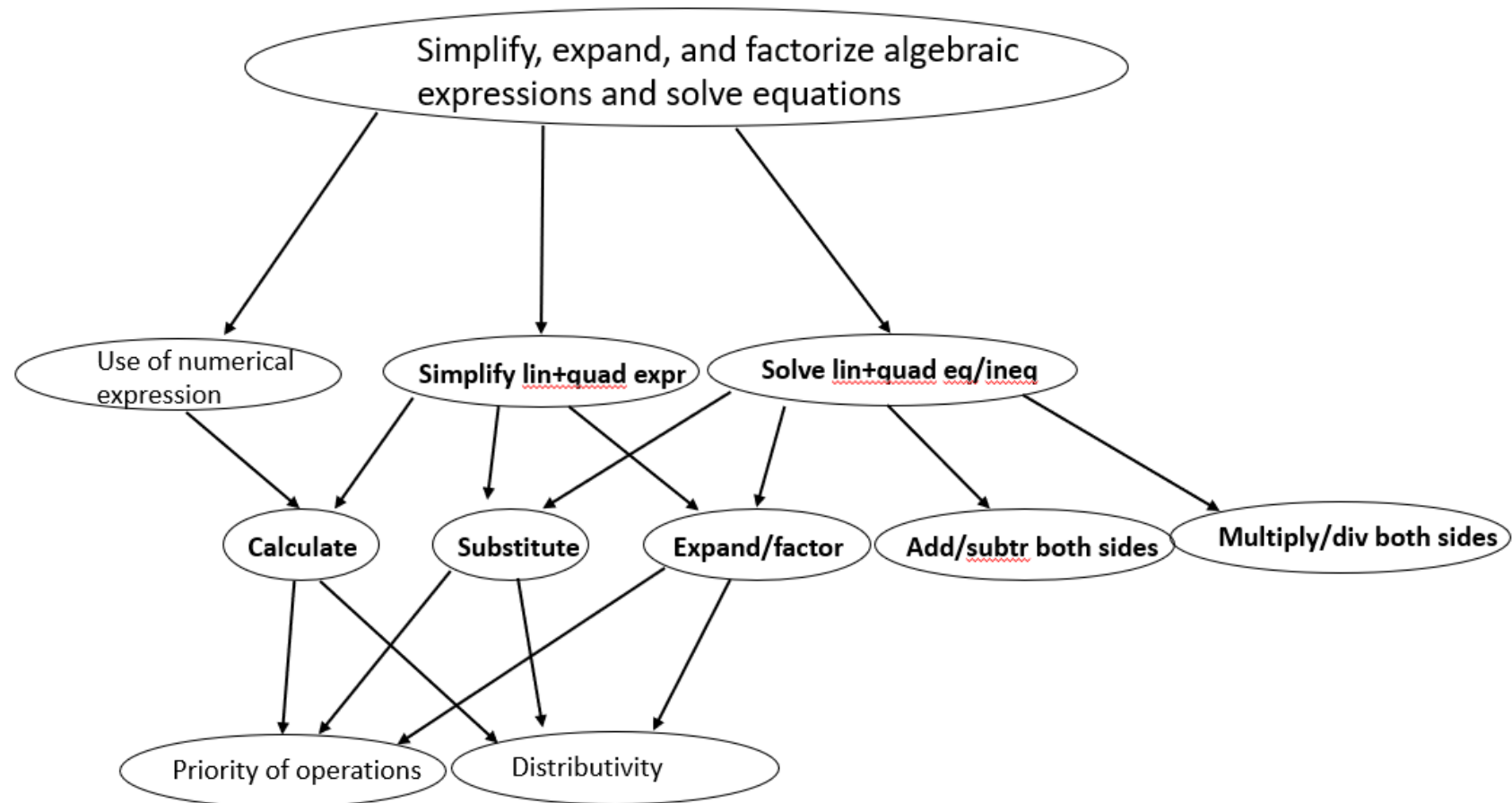
# Competencies: sketching the landscape



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# Competencies: sketching the landscape



# Task design



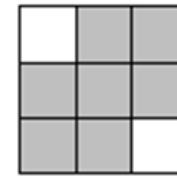
## Criteria:

- The task concerns the domain Relationships and fits in the 12-15 year old student's competence;
- The task involves setting up algebraic expressions, equations, and inequalities, as well as simplifying and solving them;
- The task involves multi-step solutions.

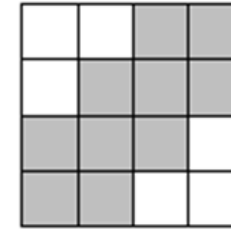


# Task design resources

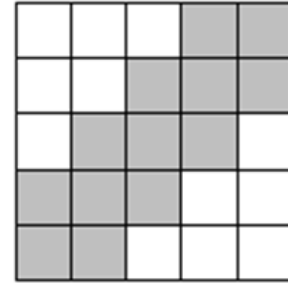
- Pépite materials (Paris)
- CITO (Arnhem)
- Freudenthal Institute (Utrecht)
- USAR (Saarbrücken)



1



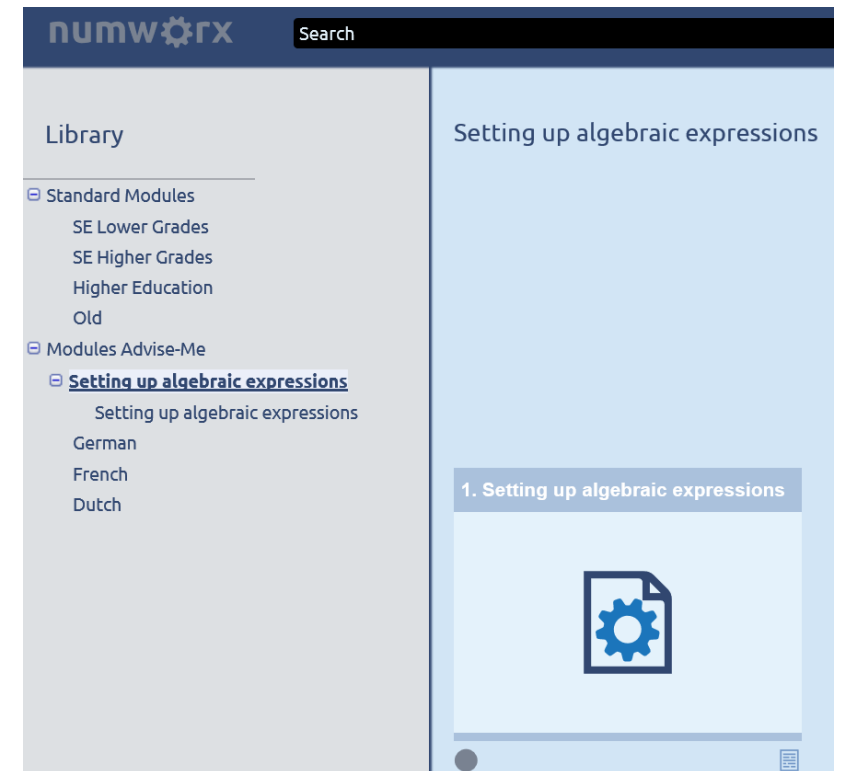
2



3

# First set of tasks

- 10 tasks
- Revised twice
- Implemented in DME
- Small-scale pilots in
  - Germany (19 students)
  - France (20 students)
  - the Netherlands (39 students)



# Task – Competencies Table

#	Title	R1	R2	R3
1	Rectangle area	X	X	X
2	Car rental	X	X	X
3	Pattern	X	X	X
4	Making a square	X	X	X
5	Magical trick?	X	X	X
6	Theatre rate	X	X	X
7	V-patterns	X	X	X
8	Area of a triangle	X	X	X
9	Area and expression		X	
10	Matryoshka doll	X		X



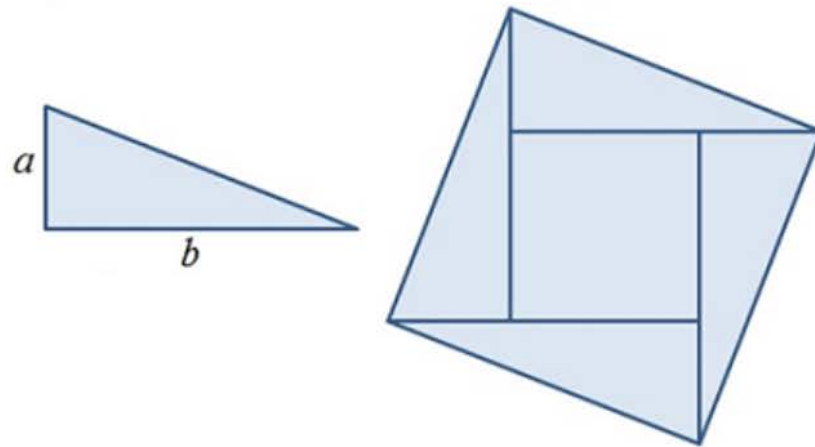
# Task example (1)

<https://app.dwo.nl/en/student/>

## Task

### 01 Making a square

Below you see a right-angled triangle with adjacent sides of length  $a$  and  $b$ . Four of these triangles are put together in such way that they form a big square that includes a smaller square.



Express the area  $A$  of the big square in  $a$  and  $b$ . Write down your intermediate steps.

## Your work

$f(x)$

|

Submit

# Task example (2)

<https://app.dwo.nl/en/student/>

Task

## 02 Matryoshka doll

On your right hand side you see the first three of a series Matryoshka dolls. The puppets fit into each other, due to a decreasing height. The biggest puppet is 32 cm high. Each next puppet is 25% smaller than the previous one. In this sequence, there are no puppets smaller than 6 cm.



How many puppets are there in this series?  
Write down your intermediate steps.

Your work

f(x)

|

Submit

# Future plans

- An additional component on **Basics & Preliminaries (R4?)**
- **Additional tasks concerning the relationship Numeric – Algebraic:**
  - Some open tasks in which students make sensible choices between numerical and algebraic approaches
  - Some tasks in which a numerical approach will not do the job
  - Some tasks which explicitly ask for algebraic solutions

# Reflection: Boundary Crossing Challenges

- Different scientific domains: Mathematics education and computer science
- Different languages
- Different educational goals and cultures

## References

- Arcavi, A., Drijvers, P., & Stacey, K. (2017). *The Teaching and Learning of Algebra: Ideas, Insights and Activities*. London / New York: Routledge.
- Grugeon-Allys, B., Pilet, J., Chenevotot, F., & Delozanne, E. (2012). Diagnostic et parcours différenciés d'enseignement en algèbre élémentaire. *Recherches en Didactique des Mathématiques*, Enseignement de l'algèbre, bilan et perspectives, hors-série, 137-162.
- Kieran, C. (2007). Learning and teaching algebra at the middle school through college levels: Building meaning for symbols and their manipulation. In Frank K. Lester (Eds.) *Second Handbook of Research on Mathematics Teaching and Learning* (pp.707–762). Greenwich, CT: Information Age Publishing.