DEVELOPING FUNCTIONAL THINKING FROM TEACHER EDUCATION TO PRIMARY SCHOOL

WALKING THE NUMBER LINE

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INTRODUCTION

Functional thinking is described "as the process of building, describing, and reasoning with and about functions" (Pittalis et al., 2020, p. 632). Understanding of, and reasoning about, descriptions of relations between quantities is an important aspect of mathematical learning and essential for anyone to function in society.

Performing, guiding, and designing activities to support functional thinking is currently not part of the curriculum neither in primary education nor teacher education in the Netherlands. That results in the absence of teaching methods, experience, or knowledgeable internship mentors of preservice teachers.

RESEARCH QUESTION

HOW DO PRESERVICE TEACHERS TRANSLATE ACTIVITIES ON FUNCTIONAL THINKING FROM TEACHER EDUCATION TO PRACTICE?

HYPOTHESES

How students translate activities is dependent on:

- Their own level of functional thinking.
- Their interpretation of the activity in teacher education.
- Their beliefs on abilities of children.
- Their beliefs on teacher guidance for children's ability.

NUMBER LINE ACTIVITY

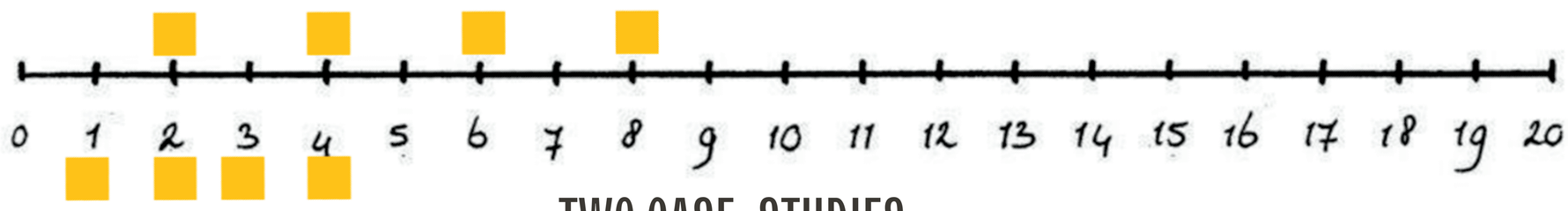
A large number line is placed on the floor. Preservice teachers get a card with a secret rule (“×2”). Other preservice teachers try to find the secret rule by walking along the number line and standing on numbers. In successive rounds, the rules go from simple to more complex, including combinations of operations ("×3-2") . The preservice teachers reason out loud and use different colored sticky notes to visualise the patterns.

FUNTHINK PROJECT

As part of the Erasmus+ Strategic Partnership *FunThink,* activities were developed to elicit primary and secondary school students' functional thinking. These activities are grounded in design principles (see below) that emerged from extensive literature research (cf. Wei et al., 2022).

DESIGN PRINCIPLES

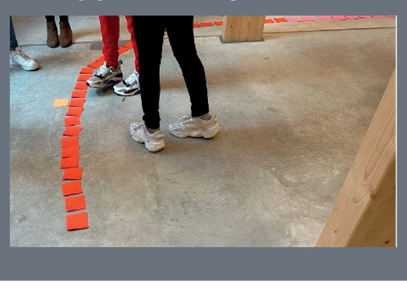
- EMBODIMENT
- DIGITAL TOOLS
- INQUIRY
- SITUATEDNESS



TWO CASE-STUDIES

CHARACTERISTICS OF TEACHER EDUCATION ACTIVITY

- Increasing **difficulty** of rules
- Students **investigate** the rules
- Teacher educator asks **open questions** in neutral terms
- Teacher educators stimulate
  - working together,
  - physical activity,
  - sticking sticky notes,
  - thinking aloud
  - making posters of thinking processes.

	PRE-TEST	TEACHER EDUCATION ACTIVITY	PRIMARY EDUCATION ACTIVITY
KLAAS	"Functional thinking is using your thoughts to solve problems effectively [...] and can therefore be taught from age of 4" 	...gives suggestions, but lets the other students perform. ...asks: "in which order" when he gets the cards (:4 +2). ...sticks sticky notes, and clearly thinks about the calculations. ...gives hints to his fellow students: "look at how difficult it is for us if you choose an uneven number".	Low-performing: +7 | +8 | ×2 High performing: +7 | +8 | ×2 | ×2+1 | ×2-2 "Maybe you should try again before you test the number?" "Encourage students to try again is important in their process" ...stimulated the students to think out loud, asked them to write their thoughts on posters and did a whole classroom discussion.
RICHARD	"Functional thinking is thinking smart, using tricks to think better or faster [...] can be taught from 12" 	...discusses with his fellow students whilst finding the secret rules, but is quiet for the rest of the time. ...listens carefully and is the first one to volunteer when being asked to perform this activity in their own internship schools and to be observed during this activity.	High performing: +3 | -7 | ×4 | ×4+1 | :2×3 Rules by students: ×5+4 | :5×6 "The next one will be more difficult" "This one is harder, now you really have to calculate" "How can you figure that out?" ...is focused on finding the right answer, then reasoning. ...tells students what to do, but asks supportive questions; doesn't encourage walking. Next time would provide paper to students.

CONCLUSION

Pre-service teachers translate activities of functional thinking to primary school practice by mimicking most of the elements of the teacher education activity . To some extent, they also adapt the activity to their own beliefs and interpretation of the activity.

funthink
Enhancing functional thinking from primary to upper secondary school

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SCAN FOR REFERENCE LIST:

HOGESCHOOL ipabo