Students in Grades 2 and 3 solving a small difference subtraction task with a number line

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Introduction

In this presentation, we report on how Grade 2 and 3 students solve a subtraction task with a small difference between the subtrahend and minuend first without a number line, and later with one. The data emerged from a collaboration project (ULF-project), conducted with teachers and researchers in preschool classes through Grade 3 during one school year. In this project, relations between numbers were emphasized, with particular attention to the number line, its structure, and use as a tool for solving arithmetic problems. Young students' ability to handle various arithmetic problems relies on flexibility, in terms of choosing an adequate strategy for solving a task based on its numerical properties. Also, students' use of strategies focused merely on manipulating digits irrespective of the task at hand has been questioned (Selter, 2001). In contrast with such strategies, recognizing the minuend and subtrahend as being close to each other may underpin strategies based on number relations (Torbeyns et al., 2009). In previous research, there are arguments for the number line functioning as a powerful representational tool that supports students' understanding of number relations. In particular, viewing the number line as a measurement, rather than a counting model, supports students when estimating the position of a given number in relation to numbers already on the line (Diezmann & Lowrie, 2006). However, how the number line may support students' use of number relations when solving subtraction tasks may be further discussed.

This presentation aims to add knowledge about how students in lower grades solve a subtraction task where the difference between the minuend and subtrahend is small, and discuss the role played by the number line as a tool in this task. The study is guided by the following research question: How do the Grade 2-3 students' ways of solving a small difference subtraction task change when a number line is provided?

Methods

22 students in Grades 2 and 3 were selected for interviews. Tasks were presented orally, and students explained their solutions verbally. The interviewer noted both explanations and gestures. The task reported here differs between the grades only by the inclusion of hundreds (Grade 3) and was presented in two steps:

1. *If you have (1)83 kronor and spend (1)77, how much is left?*
2. The interviewer then placed a number line in front of the student and asked: *Can you show it on the number line?*

We were interested in how students explained their solution without a number line and if their focus changed when one was shown. Separately, we analyzed strategies used without and with the number line shown. Then we compared them and identified two underlying approaches: *take-away* and *difference*. Finally, we analyzed each student's solutions based on these approaches and noted any changes.

Results

Seven students changed their way of solving the task from *take-away* to *difference.* For instance, Bea first solved the task by subtracting digit by digit: (100-100=0; 80-70=10; 7-3=4), answered 14. When the number line was shown, Bea reconsidered, starting at 77 and counting to 83, finding the difference as 6. This shift demonstrates a move from *take-away* to *difference*. Cai first solved the task by consecutively removing hundreds, tens, and units. When shown the number line, Cai focused on 80 as a benchmark, saying: "3 up to 80 and 3 to 83, 3 plus 3 is 6." Like Bea, Cai first adopted a *take-away* approach. After the number line was shown, his strategy shifted towards finding the difference.

One student changed from a *difference* to a *take-away* approach. Mio, focused on the small gap between the numbers and used indirect addition: "177 plus 3 is 180, 180 plus 3 is 183, 3 plus 3 is 6." When the number line was shown, Mio changed to a *take-away* approach, counting 77 single steps backwards from 83.

In total, fourteen students did not change their way of solving. Five students maintained a *difference* approach. Nine students' solutions were based on a *take-away* approach when the task was presented without a number line, as well as with the number line. These results indicate that students' ways of solving subtraction tasks may change when given access to a physical number line, as it may allow them to focus on distance and reference points. But the results also show an example of a student who abandoned an initial *difference* approach and used the number line for single-step counting.

References

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