

Proportional Reasoning and Language Background – a Pilot Study

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Introduction

In Petersson (2011) the author found indications that students following the course “Swedish as a second language” had significantly lower achievements in some specific areas in mathematics. In this pilot study the main purpose and research question is to gain insight in possible differences between how students with native and immigrant language backgrounds use proportional reasoning in missing value problems given in a national test.

Method

Data sets used in this paper are achievement rates and individual solutions from the 2009 Swedish obligatory national tests in mathematics for school year 9. The PRIM-group at Stockholm University designs the test and collects a sample for evaluation. The sample consists of two batches. Batch 1 contains credits for each test problem and (sometimes) if the student has another mother tongue than Swedish or not. Batch 2 contains individual student solutions and usually the students’ names are visible. The batches 1 & 2 are collected separately and it is common that teachers, who sent in batch 2 for some student, do not send in batch 1 for that student. Thus the language background is most times missing for the individual solutions. For the about 70 students in this study, the language background from batch 1 is known only for 12 students. Instead a probabilistic heuristic was used to categorise the students in the two groups in table 1.

Categories	Problem C1	Problem C5
HRS: High Ratio Swedish language background students.	N = 55	N = 39
HRN: High Ratio Non-Swedish language background students.	N = 11	N = 9

Table 1: Number of students in each category.

The heuristic was to decide whether a name visible in the individual solutions belongs to a Swedish name tradition or not. For example “Bernadotte” and “Sommerlath” would be put in the category HRN while “Westling” would be put in HRS. For the 12 students where data from batch 1 and 2 could be matched,

this probabilistic heuristic, when applied, separated students with only Swedish language background from other students. Bentley's (2008, p. 41-43) framework for proportional reasoning was used to categorise the solution strategies.

Result

Both student groups showed a rich and mainly similar variety in strategies for both proportional reasoning and arithmetic calculation, but there are some small differences given in tables 2 and 3.

No HRN-students but five HRS-students calculated price/minute.
HRN-students used integer arithmetic more consequently when calculating the total salary via SEK/half hour.

Table 2: Differences for test problem C1 on wages.

HRN-students' calculations were better adapted for mental calculation strategies.
Only HRS-students used "non-division strategies".

Table 3: Differences for test problem C5 "3 kiwi fruits are sold for 10 SEK. What is the 1 kg price if 1 fruit on average weights 60 g?"

An example of "non-division strategies" in table 3 is to calculate the number of kiwi fruits as " $10 \times 60\text{g} + 5 \times 60\text{g} + 60\text{g} + \frac{1}{2} \times 60\text{g} \approx 1000\text{g}$ gives 16.5 fruits per kg" and then calculate the 1 kg price.

Discussion

This small study allows no strong conclusions, but table 2 and 3 indicate some questions for further research. Do the differences hold in a larger study? Could school experience from other countries play a role in the differences in tables 2 and 3? What similarities and differences between the two student groups in mathematical thoughts are expressed in solutions that were judged as unsatisfactory and thus are *not* included in this study? The answer to such questions would help to build for equity in mathematics teaching and assessment.

References

- Bentley, P. (2008). *Mathematics teachers and their conceptual models: a new field of research*. Göteborg: Acta Universitatis Gothoburgensis.
- Petersson, J. (2011). Rare mathematics – a needle eye for mathematics teachers of second language learners. In *Proceedings from NORMA11 in Reykjavik, May 11-14*. (To appear).