Tools for teachers – The issue of developing mapping tests for primary school mathematics teachers

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How can tools be developed that enable teachers to provide equal opportunities for all students to learn mathematics? Norwegian schools are inclusive schools, and students with identified special needs in mathematics should receive extra attention and, if necessary, be offered special needs education. However, special needs education is typically delayed to middle or secondary school. Primary school teachers tend to wait and see if students can overcome their difficulties with the assistance provided in the general teaching activities (Nordahl & Hausstätter, 2009). Thus, targeted intervention for at-risk children is often delayed until they have developed a real problem in learning mathematics. This is recognized at a national level and in 2006 early intervention became a national policy (MER, 2006). In 2008, the Norwegian Directorate for Education and Training (NDET) implemented a mandatory national mapping test to help Grade 2 teachers screen their students in mathematics. The test should identify students with weak conceptual understanding of numbers and lack of procedural fluency in counting and basic arithmetic operations (Throndsen & Turmo, 2012), that is, the weakest 20% of the students, including students with mathematics learning difficulties. Subsequently, tests for Grades 1 and 3 have been developed.

The mapping tests are expected to be of such a quality that they can be used several years, thus, should be revised after five years (NDET, 2011). At the moment, EKVA/ILS is developing the second generation of the mapping tests, to be implemented April 2014. Tests should have a ceiling effect by design, and they should discriminate more efficiently and securely between students just above and below the 20% cut-off score (the two lowest quintiles) (NDET, 2011). Most items should have a p-value between .70 and .90. As some students might not read well, test items are printed in test booklets and standardised oral instructions are given for each page by a test administrator (i.e. the class teacher).

In accordance with the test framework, for each page in the test, a cluster of items with the same answering format has been developed. Recent research on mathematics learning difficulties, research on primary mathematics and experiences from the first generation of screening tests have informed the work of the item developers. Students' understanding and use of the number line can

serve as an example of one key aspect of the test construct. This aspect includes knowledge of the number sequence, counting of concrete objects or structured groups of objects and placing the correct number on the number line, as well as using an unlabelled line. Number line items will be used to illustrate the presentation. Two pilot tests for each grade level (1 – 3), including an anchor test, were developed and piloted with national representative samples (N = 550 – 600 students for each pilot) during the spring of 2013. The students' class teachers served as test administrators. Most teachers filled out a questionnaire about test implementation in their group of students.

Experience and analysis from item development and piloting reveal that the item format plays a crucial role; the size of the numbers, the labelling of the number line, and the grouping of the objects influence the difficulty level of the item considerably. Students were divided into quintile groups and compared for all items. Analyses reveal that the first quintile group can confidently place small numbers (< 20) on the number line. They need more time than other students to count up and down the number line, especially when only end points are labelled. When attempting to identify the value (structured groups, for instance groups of coins with values of 1, 5 and 10) and tie this amount to the number line, they might struggle both to count and to identify the correct number on the number line. It may be assumed that students start counting from 0 on the number line when solving these items, rather than using the identified numbers. When tests are to be targeted to the lowest quintile group, this consequently effects item and test development as items needs to be tailored to the students in question. At the same time, when tests are targeted to the conceptual understanding and procedural fluency of the students you want to identity, more information is provided about the at-risk students at students given the high ceiling effect can correctly solve up to 80% of the items on the test providing knowledge of what students can do as well as what they cannot.

References

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