Summary

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The report assesses the level of mathematical competence and the factors connected to it at the end of upper secondary school education (high school), 12th grade. The materials used represent the fourth set of materials that have been gathered from the same students; the mathematical competence of the students has been monitored at the transitional phases of their primary education after the 2nd grade in 2005, after the 5th grade in 2008, at the end of the 9th grade in 2012, as well as at the end of their secondary school education in 2015.

The final target group included 2,108 upper secondary school students, of which 1,310 answered the test and the related background survey. Of the potential respondents, 798 (38%) did not want to participate in the data collecting despite being offered to do so on numerous occasions. Of the students, 2,002 could also provide their results from the 9th grade and 961 students their matriculation examination information. The students who participated in the data collecting were on average somewhat more motivated and advanced in their mathematical competence than those who did not participate. As such, when we describe the results that were provided by the end of the upper secondary education, please note that these results provide a slightly overly positive picture of the students' competence. However, these materials include a fairly comprehensive number of students representing all levels of competence at the end stage of their upper secondary education from the different parts, municipality types and language groups of the country.

The competence test was based on the test that the students had already completed in the 9th grade. 78 per cent of the tasks were taken directly from that test. Some of the tasks had already been included in the 6th grade test and some in the 3rd grade test. As new tasks, the test included two tasks from the matriculation examination of the basics mathematics syllabus and two from the matriculation examination of the advanced mathematics syllabus. In addition to completing the tasks, the students answered a background survey. Information on the number of completed courses and given marks of all target students were gathered from institution registers. Matriculation examination grading information was also utilised as additional material.

When evaluated as a whole, there is a clear increase in mathematic competence during the studies in the upper secondary schools. A large part of this increase can be explained by the effect of the advanced syllabus courses in mathematics. There is a clear difference in competence between the basic and advanced syllabus mathematics.

From the point of view of longitudinal materials, it is apparent that the differentiation in mathematical proficiency happens during the early school years, but this differentiation is especially apparent when arriving in the upper classes of basic education in the 9th grade and continuing from there on out until the end of the upper secondary level. The mathematical competence level of those students who only completed the minimum number of courses remained at the level that they achieved during the 9th grade. The differences between upper secondary school students can largely be explained by the number of mathematics courses chosen during the upper secondary school and the grades received. With the minimum number of courses, the 9th grade competence level in mathematics can barely be maintained, but for those students that completed over 13 courses and received at least a mark 8 (good), there is a clear rise in their competence level – 84 PISA scale units on average. The competence required for a good grade is very different for basic and advanced syllabus courses. The competence of those students that complete the minimum number of basic syllabus courses (6 courses) and receive a mark 10 (the highest possible) is equivalent to the competence of those students that complete the advanced syllabus (12 courses or more) with a mark 6–7 (lower than "good"). The competence of those students that complete more than the minimum number of basic syllabus courses (7–11 courses) and receive a mark 10 is equivalent to the competence of those students that complete the advanced syllabus (12 courses or more) with a mark 8.

Men are significantly more successful in mathematics than women by the end of the upper secondary education. The average competence of women in upper secondary school trails men by approximately one year. By the end of the upper secondary school, 35% of the most mathematically proficient students (the highest decile) are women and 65% are men. In every proficiency level group, female students felt significantly and notably more negative emotions during their studies and, except for the very best students, their self-efficacy was lower than that of male students'.

Different language groups provide the chance of achieving an equal mathematical competence level. Swedish-speaking students rose to the level of Finnish-speaking students from clearly weaker starting points and achieved the level of Finnish-speakers by the beginning of the 6th grade, after which there were no differences between any of the groups that were studied. The change has been especially major in the non-urban areas of the former province of Southern Finland.

There is a clear connection between having parents with an upper secondary school education and a better result in mathematics by the end of the upper secondary level. Both parents having completed the matriculation examination – independent of the compositions of their matriculation examination tests or the points received – adds around a 1.5–2 year study advantage for overall competence when compared to those students with neither parent being an upper secondary school graduate. However, the benefit of a matriculation examination does not seem to increase in upper secondary school education: the difference between students with upper secondary school graduate parents and students with non-upper secondary school graduate parents is formed during the lower grades and remains the same throughout the school years.

When assessing the pedagogical solutions of teachers, the key factor for explaining *competence* in secondary school education is how often the students feel that the matters studied became clear to them. However, it is difficult to determine the cause and effect: it is unclear whether the lack of competence in students is the result of the matters not becoming clear to them or if the matters do not become clear to them since their level of competence is low. It seems likely that, in the best student groups, the best results are achieved with a teacher-led model in which a meaningful differentiation in accordance to competence levels and assessment of the gained results' meaningfulness are combined in the teaching.

The *change* in competence cannot really be explained with factors related to the teacher's pedagogical solutions. The majority of the changes in competence during the upper secondary level can seemingly be explained with other factors. The school's role in both competence and in the change in competence is around 8–9%, which is at a similar level as in basic education. The size of the upper secondary school does not explain the variation in competence.

The given school marks (4–10) in schools with the best and weakest results do not match. Those schools that receive the best results clearly require more competence for the student's final marks than those schools that receive the weakest results. The differences between the different mark groups are remarkable, around three grades worth: a mark 6 from a high school with a high performance seems to correspond to a mark 9 from a high school with low performance. The difference is apparent and leads to a clear inequality when students apply for further education, assuming that the upper secondary school certificate is used as part of the application process.