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MATHEMATICS IN THE SHADOW OF COVID-19 PANDEMIC – Achievement in mathematics at the end of 9th grade in spring 2021

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The national assessment of learning outcomes in mathematics in the 9th grade was carried out in the shadow of the COVID-19 pandemic; the assessment of achievement in mathematics was administered approximately one year after Finland had switched to distance learning to curb the pandemic. In spring 2020, all students were in distance learning, and during autumn 2020 and spring 2021, the students were varying periods partly in distance learning and partly in contact learning depending on the region and school.

The learning outcomes in mathematics were digitally assessed in all six content areas described in the National core curriculum for basic education (Skills and methods of thinking (S1), Numbers and calculations (S2), Algebra (S3), Functions (S4), Geometry (S5), and Information processing, statistics, and probability (S6)) and in twenty target areas. The sample consisted of 167 schools and 12,482 students (23 % of the age group) from different parts of Finland and different types of municipalities. Of the schools of study, 153 were Finnish-speaking and 14 Swedish-speaking. Similarly, 11,507 students were Finnish-speaking (92 %) and 975 Swedish-speaking (8 %).

This report describes the results from the perspective of equality. Later reports will analyse the background information of a student and teacher as an explanatory factor of achievement in mathematics in more detail.

Based on previous assessments, it is known that the self-determination, motivation, and family support of all students were not optimal for the success of their home studies. However, some of the students even benefited from remote school. In most schools, students had already returned to contact learning during the assessment, but part of the students completed the assessment from home. The response technique of students differed from previous assessments: many students did not include the reasoning for the mathematical problems, even though, according to the teachers, the students would have been able to write them down on paper. In addition, distractions related to information technology and networks in the test situation may have had a negative impact on the results. Such factors influence the fact that the national profile of achievement level differs from previous ones.

In 2021, the average level of achievement was 451 points, which is 49 points lower than in 1998 and 28 points lower than in 2012. In other words, the level of achievement in mathematics has fallen from the previous assessments. This is consistent with the changes in previous years: the achievement has been in a downward trend since 2001. Unlike in previous assessments of learning outcomes in mathematics, the students' overall achievement level in mathematics is not distributed normally, as it is clearly composed of three populations: low performers, high performers, and the population of average performers in between. Some of the changes can be seen as results of the COVID-19 pandemic, while others can be explained with the aforementioned issues related to response techniques, such as missing values in the test items related to reasoning. The unusual form of distribution of the test scores in mathematics suggests that educational equality does not materialize in Finland as well as previously. Attention should be paid to this in future assessments: will the extreme populations revert to a single normal distribution. It is possible to correct the shortage of learning outcomes identified in the lowest achievement group by correctly targeted support measures.

In general, the differences between schools are as large as in previous assessments, but the average achievement level of students from the area of Lapland Regional State Administrative Agency was noticeably lower than that of others. There are no significant differences in average achievement levels between the types of municipalities, Finnish and Swedish schools, and genders. The schools' role in student variation is increasing.

The policies for grading vary between schools; relative to the level of achievement in mathematics, students in the least successful schools receive approximately one grade higher than students in the most successful schools. Girls receive higher grades relative to the level of achievement level, a phenomenon that has been observed since 2004. With the new grading criteria introduced in 2021, student evaluation can become more unambiguous.

Attitudes towards mathematics were assessed with three sub-scores: self-efficacy in mathematics, liking of mathematics, and the perceived benefits of mathematics. The self-efficacy in mathematics has lowered especially in groups of high-performing students. Girls view their own level of achievement lower than boys at every grade and achievement level. In this respect, the situation has not changed in the last ten years.

Since 2008, FINEEC's assessments of learning outcomes have also included a question regarding the experienced bullying among pupils. This has been reported with the connection to achievement level. This time, there were six questions related to school bullying that surveyed bullying as a physical, psychological, and social phenomenon. Approximately 7 per cent of students experience weekly and extensive bullying. *In quantitative terms*, a student who is subject to repeated and extensive bullying is most likely to come from (1) a Finnish-speaking school, (2) does not have an immigrant background, (3) is Finnish- or Swedish-speaking, (4) receives general support and (5) is not from the metropolitan area. *In relative terms*, the most likely target for repeated and extensive bullying is (1) a low-performing student regardless of gender or status of Finnish as a second language (L2), (2) a low-performing L2 student regardless of gender, (3) a low-performing boy without L2 status, (4) an average-performing boy with L2 status, or (5) a high-performing girl.

From the perspective of correlation, first, repeated and extensive bullying is common at both extremes of achievement. Secondly, we do not know whether a student would be bullied less if his or her level of achievement was more average. The bullying of average-performing boys with L2 status does not give a positive signal on the subject. However, the material does not provide the opportunity to determine whether the achievement level of low-performing students who have experienced intensive bullying would be higher if they were not bullied.

The differences in average achievement levels between schools seem to increase furtively, which is reflected in the fact that the school's explaining power, i.e., the coefficient of determination, in student variation increases slightly but systematically from one assessment to the next. The coefficient of determination outside the metropolitan area has remained similar in the latest assessments or increased only marginally. However, in the metropolitan area and especially in Helsinki and Vantaa, the school's coefficient of determination has multiplied itself in ten years (12-15 %). This has an impact on the national average. Attention should be paid to this in future assessments.

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