

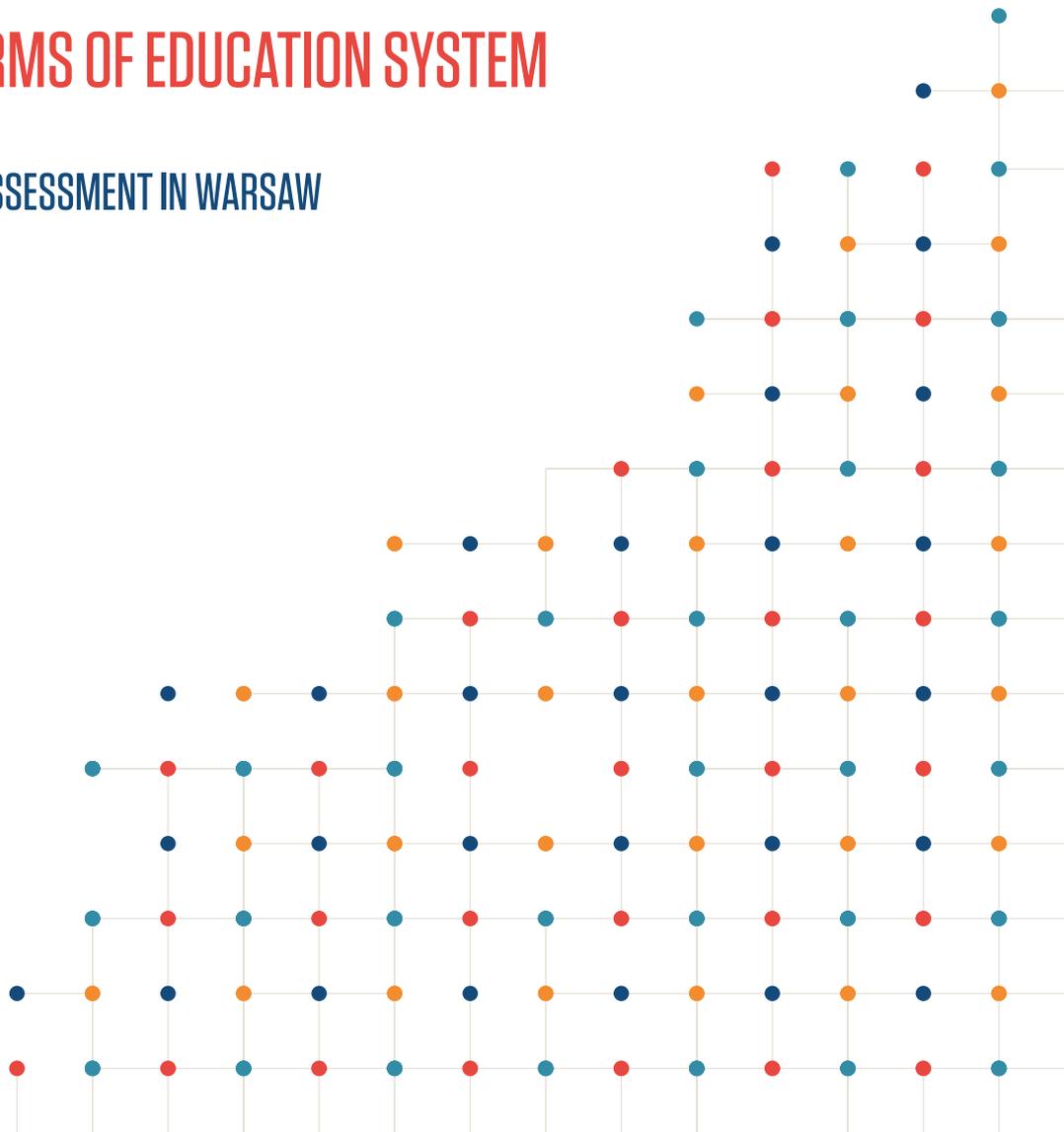
# POLICY NOTE

# 1/2022

## ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS AFTER PANDEMIC LOCKDOWN AND STRUCTURAL REFORMS OF EDUCATION SYSTEM

RESULTS FROM TICKS 2021 ASSESSMENT IN WARSAW

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**The PISA assessments conducted between 2003 and 2018 revealed that Warsaw students were among the top students from the largest cities in the world** (Jakubowski et al., 2019). Among students from cities of over 1 million inhabitants (for which a sufficiently large sample from the PISA survey is available), 15-year-olds from Warsaw obtained the highest results in reading. In mathematics, students from Warsaw were outperformed only by students from Singapore and Taiwan, while their results were comparable to students from Japan, Hong Kong, and Korea. Students from other large cities in Europe, Asia, and America, demonstrated significantly lower skills in these critical subjects.

**However, these were the results obtained by students of final grades of lower secondary schools who had experienced neither teaching in a pandemic nor recent structural changes in education.** According to most studies from other countries, remote education during pandemics caused significant educational losses (Donnelly, Patrinos, 2021). In Poland, schools were closed for longer than in most European countries. According to the UNESCO data, schools in Poland were closed for 29 weeks, while in most European countries for which pandemic-related education losses are available, schools were closed for around ten weeks. In addition, the digital readiness of students and schools in Poland was relatively low. Before the pandemic, students and teachers used digital tools for learning in computer or language classes in most schools, but rarely in other subjects. Thus, one can expect that distance learning could have a detrimental effect on student achievement in Poland.

**The negative impact of the pandemic could strengthen the effects of structural changes that were implemented in Poland since 2016 and partly reverse the successful reforms that have started in 1999.** In 2016, the lower secondary schools were liquidated despite the evidence from PISA showing considerable improvements in the achievement of 15-year-olds who attended these schools (Jakubowski et al., 2016). The new structure comprises eight years of primary school followed directly by secondary education with different programs (vocational, vocational-academic, academic). In the old structure, students would go to three-year lower secondary schools after finishing six years of primary school and then go to upper secondary schools with different programs after passing the lower secondary school national exam. The government also changed curricula and national examination standards, dropping science subjects from the exams at primary education. Thus, the changes shortened the period of education with a common curriculum and limited the number and content of national examinations.

**The challenges faced by schools in recent years require a thorough diagnosis and discussion on supporting students, parents, and teachers. So far, no representative surveys using standardized tools have been carried out in Poland to reliably assess how student achievement has changed due to distance teaching in pandemic and structural reforms.** The last PISA research in 2018 covered one of the last cohorts attending the now liquidated lower secondary schools, and the next ones were postponed from 2021 to 2022 due to the pandemic. Therefore, the Warsaw local government decided to conduct a TICKS study on a representative sample of secondary school students to assess their current achievement.

**The TICKS (Test for International Comparisons of Knowledge and Skills) study refers to the PISA research methodology.** It is based on similar test tools to measure mathematics, reading, and science. These tools are enriched with questions directly related to the Polish curricula and test items that follow the PISA assessment framework. Advanced psychometric modeling and the link items common to PISA and TICKS assessments allow reporting the results on a scale directly comparable to PISA results. The study was developed by a team of experts from the Evidence Institute Foundation based on the experience gained during the implementation of the PISA assessments in Poland and the national surveys of student competencies, in which a total of tens of thousands of students participated. In addition to cognitive tests, the survey includes direct questions and Discrete Choice Experiments collecting information on learning methods and techniques, motivation, the teacher-student relationship, and students' preferences towards an educational and professional career.

The results are based on a random sample of 83 secondary schools and randomly selected 208 classrooms within these schools. In each school, one classroom was sampled for each of the 2021 study cohorts:

- 2nd grade, after the newly established eight-year primary school,
- 3rd grade, after the newly established eight-year primary school,
- 3rd grade, after the liquidated lower secondary school.

**In total, data for 4581 students were collected, with a response rate above 80%.** Most students and classrooms who did not participate in the study were sick or on COVID-related quarantines. Thus, most non-response was random. In each cohort, data for around 1300-1600 students were collected. The final sample was large enough to precisely assess student skills and compare them with the results obtained by 15-year-olds in Warsaw in PISA 2003-2018. In addition, the multiple imputation method was used to fill the gaps in responses in single tests or questions to maintain a full sample for the analysis while preserving correlations observed in the original data. A full description of the methodology and a complete analysis of the results will be available in the upcoming research report (Jakubowski, Gajderowicz, Wrona, 2022).

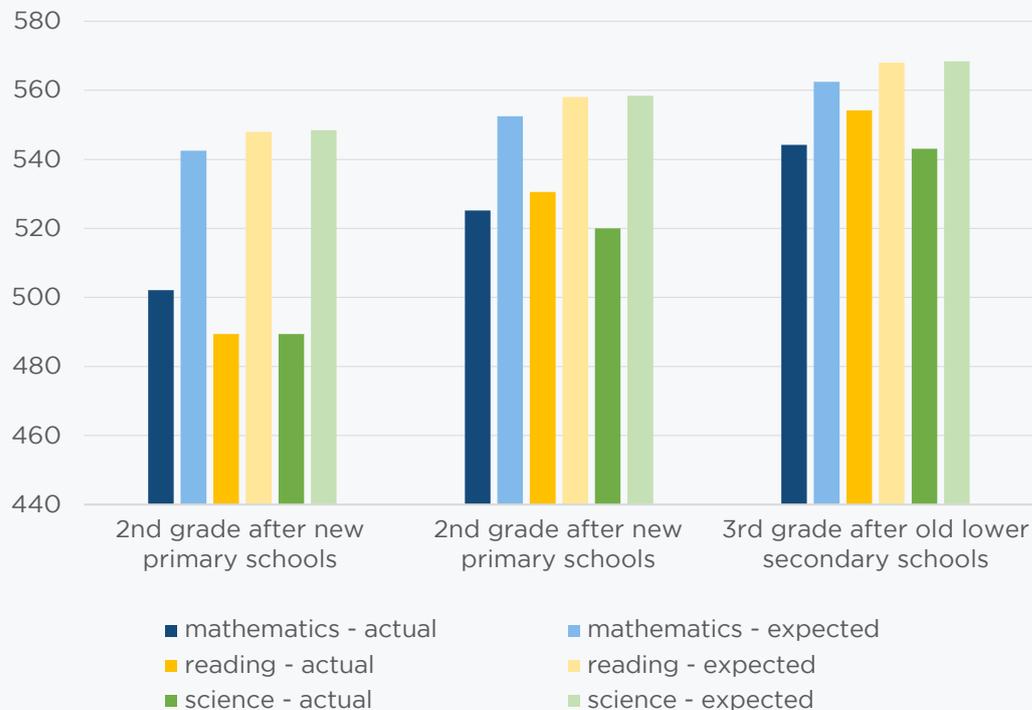
**Students who participated in the TICKS 2021 study were older than those in the PISA assessment. Thus, before comparing PISA 2003-2018 and TICKS 2021, adjusting the results for age and additional education effects is necessary.** In 2006, 2009, 2012, the so-called national option was implemented in Poland, which used the same test instruments as for 15-year-olds in the international sample to measure student achievement in upper secondary schools. Comparing their results enables estimating the increase on the PISA scale equivalent to one additional year of education and the rise in student age. These data suggest that the change over the year in students' knowledge and skills during secondary education corresponds to about 10 points on the PISA scale. This is less than the average effect of one year of schooling estimated using data from multiple countries (Avvisati, Givord, 2021, provide an average estimate of approx. 20 points on the PISA scale). However, international data suggest that this effect is not uniform. The increase in knowledge and skills depends on the quality of teaching, the curriculum, and other features of a given education system.

An additional challenge in comparing the results of TICKS and PISA is that these studies took place at different times in the school year. PISA is conducted in spring, but TICKS was postponed from spring to autumn due to school closures. However, research on the "summer gap" documents loss in knowledge during the summer holidays. Also, schools were open for just a few weeks in spring 2021 before the summer holiday started, and TICKS started testing students a few weeks after the beginning of the 2021/2022 school year. For these reasons, we assumed that the results of 15-year-olds in PISA are directly comparable with the 2nd-grade students of secondary schools tested in TICKS. For the 3rd-grade students after the newly established eight-year primary school, we assumed that they benefited from one additional year of education compared to 15-year-olds in PISA. For the 3rd-grade students after lower secondary schools, we assumed that they had benefited from additional two years of education compared to students tested in PISA. Note that assuming a greater than 10-points increase over one year of schooling, or assuming larger differences in the time student spent in education between PISA and TICKS, we would have to expect even higher results from secondary school students tested in 2021. Thus, under our assumptions, the differences between PISA and TICKS provide a lower bound of potential educational losses.

## EFFECTS OF REFORM AND EDUCATION IN PANDEMIC

**Figure 1 shows the actual student performance in 2021 in mathematics, reading, and science using darker bars. The expected results are presented in a lighter shade, which was calculated using 2003-2018 PISA results with a correction for an additional year or two of education.** As explained above, for 2nd-grade students, the expected results are the same as the average results of 15-year-olds from Warsaw tested in PISA in 2003-2018. For the 3rd-grade students after the new 8-years primary school, the expected results are based on PISA results but with an addition of 10 points. Finally, for the 3rd-grade students after lower secondary schools, the expected results are based on PISA with an addition of 20 points.

FIGURE 1. ACTUAL AND EXPECTED ACHIEVEMENT IN TICKS 2021



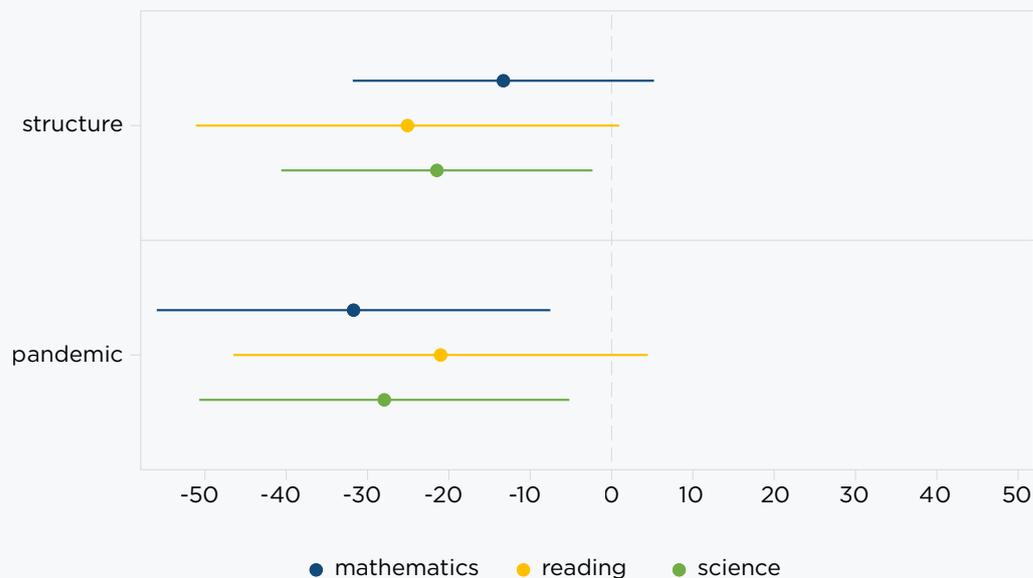
**The results show a significant educational gap for 2nd-grade students as their actual results are lower than expected by approximately 40 points in mathematics and almost 60 points in reading and science. For the 3rd-grade students after new primary school, the differences between actual and expected results are smaller.** In mathematics and reading, the results are lower than expected by approximately 27 points, and in science, by almost 40 points. For the 3rd-grade students after lower secondary school, the gap is the smallest, but the actual results are also lower than expected: by 18 points in mathematics, 14 in reading, and 25 in science.

**The results from the TICKS survey in 2021 show a considerable decrease in the achievements of Warsaw students compared to previous years. The resulting educational gap may be related to changes in education introduced since 2016 and losses during education in the pandemic.** These two effects can be separated by comparing the differences between the actual and expected results of the different cohorts. All age groups examined in 2021 experienced teaching in a pandemic, so the related effect will be visible in the results of all the cohorts from the TICKS study, but not among the 15-year-olds from the PISA assessment. On the other hand, third-grade students of secondary schools after lower secondary schools spent most of their education in a system similar to the one in which the 15-year-olds from the PISA survey participated. Therefore, it is possible to distinguish the effects by comparing the differences in the results of the respective cohorts.

Figure 2 shows separate estimates of the impact of the structural changes implemented since 2016 and of the impact of distance learning during the pandemic. The effect of structural changes was estimated by comparing the results of 15-year-olds students in PISA 2003-2018 and the results of the 3rd grade of secondary school after lower secondary school with the results of students who had completed the newly established eight-year primary school. This effect was taken into account when measuring the impact of teaching in the pandemic on student performance by comparing the expected results based on the PISA assessment from 2003-2018 with the results obtained from the TICKS study in 2021. To estimate these effects, a regression model with data at the student level was used, where differences in the gender distribution and socio-economic status of student families were additionally controlled. The results were also adjusted for possible differences in tests carried out on paper (PISA between 2003 and 2012) and computer-based tests (PISA 2015 and 2018 and TICKS 2021) to exclude test mode effects from the final results.

Figure 2 shows estimates of the impact of structural changes and education during the pandemic on results in the three key domains. The point estimates (dots) are shown together with the 95% confidence intervals (horizontal lines) to assess whether the

FIGURE 2. IMPACT OF EDUCATION IN PANDEMIC AND STRUCTURAL CHANGES IN EDUCATION ESTIMATED FOR SECONDARY SCHOOL STUDENTS IN TICKS 2021



effects are significantly different from zero. For convenience, a vertical line has been added at the zero level, so the estimates where the confidence interval intersects this line are not statistically distinguishable from zero at the 95% confidence level.

**The point estimates of the impact of structural changes range from minus 25 points in reading, through minus 21 points in science, to minus 13 points in mathematics.** Only the results in science are significantly different from zero. However, taken together, these estimates suggest that the reform negatively affected student achievement, corresponding to the loss of at least one year of education.

**The impact of the pandemic on student achievement is more negative. In mathematics and science performance declined by approx. 30 points.** For both domains, these declines are statistically significant (below zero). In reading, the impact of the pandemic is around minus 20 points, but the estimates are imprecise and are not significantly different from zero at the 95% confidence level. The learning losses due to the pandemic are greater than those of the structural changes and correspond to effects associated with more than one year of education.

## CONCLUSIONS

Warsaw's economy relies on its citizens' ideas, knowledge, and skills. Its impressive economic growth over the last 30 years was mainly driven by improvements in human capital thanks to successful school education reforms, the rapid expansion of tertiary education, and attracting the most talented people in Poland and other countries. The recent changes in school structure, politically-driven reversal of successful reforms, and a relatively long period of school closures endangered the quality of education and human capital development of the youngest cohorts. The City of Warsaw with the Evidence Institute Foundation implemented a large-scale assessment of student knowledge and skills TICKS 2021, which measures student achievement in mathematics, science, and reading on a scale directly comparable to the international scale of the PISA study. Comparing the results from PISA that were obtained by 15-year-olds from Warsaw between 2003 and 2018 with the results from 2021, one can assess how the pandemic and structural reforms affected student achievement.

**The results show considerable educational losses of secondary school students, comparing their results in 2021 to the PISA assessments from 2003 to 2018. The losses are partly related to structural changes, which negatively affect student achievement. Still, more significant is the decline in student achievement associated with distance learning during the pandemic.** The results are representative for Warsaw students, but there is no reason to expect that similar educational losses are not present in Poland as a whole. The large decline in student achievement should be addressed by targeted interventions to close the educational gap. Without it, several cohorts of students will suffer in the future from the lower levels of skills, and the overall negative impact on the economy might be larger than investments required today to strengthen support for education.

## LITERATURE

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