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Inequalities in Education across Canada : Lessons for the Pandemic

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Inequalities in Education across Canada: Lessons for the pandemic

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Abstract
Schools have been closed across the country and will remain closed until September in most provinces. The decision to reopen should take into account current inequalities in cognitive skills across the country and the impact of school interruptions on knowledge accumulation. In this article, we use results from a companion paper on the achievement gaps of 15-year-olds across Canada to estimate the impact of the pandemic on inequalities in education. Using estimates from the literature on the impact of school closures, we estimate that the socioeconomic skills gap measured using PISA data could increase by more than 30 percent.

1. Introduction

In the midst of the COVID-19 pandemic, primary and secondary schools across the country have been closed, yet school interruptions are known to have short and long term negative effects on students' academic outcomes and perseverance (e.g. Meyers and Thomasson (2017); Belot et al. (2010)). These effects differ by socioeconomic status (SES) and therefore school interruptions have the potential to exacerbate inequalities among students. As a result, the decision to reopen schools across the country should take into account current inequalities in education across the country. Using PISA data, combined with the approach used in a companion paper (Haeck and Lefebvre, 2020) on achievement gaps of 15-year-olds across Canada, we provide a back-of-the-envelope calculation of the impact of the pandemic on SES inequalities in education.

2. School interruptions, a brief review

Schools have been closed across the country and will remain closed until September, yet the literature shows that school interruptions can have a negative impact on students' academic skills and perseverance (e.g. Cooper et al. (1996); Meyers and Thomasson (2017); Belot et al. (2010)), and these impacts may differ by socioeconomic status.

Several strategies have been used to document the impact of school interruptions on academic achievement. The literature that exploits summer learning losses finds mixed results on average, but seems to suggest that mean declines or stagnation typically hide differences by socioeconomic status (see Atteberry and McEachin (forthcoming) for a complete review). Many recent studies refer to kindergarten children (e.g. Downey, Von Hippel, & Broh (2004), Von Hippel and Hamrock (2019)), which is not our main focus here. Atteberry and McEachin (forthcoming) exploit data on over 200 million test scores in 32,000 schools across the United States between 2008 and 2016. They find mean summer losses in grades 1 to 8 in both math and english, and the variance of summer learning losses is large. This implies that some students lose a lot of ground, while others gain some ground. Race and SES only explain a small fraction of the variance, but they certainly do play a role.

Cooper et al. (1996) review the literature on school interruptions during the summer and find that students lose about one month of equivalent schooling over the summer. Their meta-analysis also suggests that the impact is steeper in higher grades and losses are more important in math than in reading. Finally, they document a differential impact in reading based on the SES of the students. Students from low-income families experience a decline in their reading skills (-1.5 months) while students from middle- to high-income families experience an improvement in their

reading skills over the summer (+2.3 months). This study is somewhat dated, since the studies were conducted in the 1980s, and the findings may not apply in the current context. On one hand, given that the labour force participation of mothers has increased over the last 30 years, mothers may not be as available during the summer months to supervise their children and, therefore,the learning loss may be higher now than before. At the same time, families with dual-income parents have more income resources than ever before and they may therefore be able to provide an enriched environment during the summer months. Finally, in the specific context of the pandemic, more educated parents are more likely to have flexible jobs, access to computers (Frenette et al. 2020) and resources to help their children. In this sense, the impact may in fact be even stronger as parents may get more involved than they normally would during the summer.

More recently, Frenette (2008) exploits regulations around school entry age to document the impact of instructional time. He finds that one less year of schooling is associated with a score that is 6 percent lower in reading, 5.9 percent lower in math, and 4 percent lower in science.

Finally, Meyers and Thomasson (2017) study the impact of school closures during the 1916 polio pandemic. School closures occurred at the beginning of the school year and lasted only a few weeks, yet it had devastating effects on school perseverance. They find that school closures reduced educational attainment of children aged 14 to 17 during the pandemic, but not that of younger children. They find that a one standard-deviation increase in the number of polio cases caused one in every fourteen students to achieve one less year of schooling. This is an important lesson for high schools come September. Finally, Belot et al. (2010) study teachers' strikes in Belgium in 1990 and also reach a similar conclusion that school interruptions affect educational attainment in a permanent way.

3. Pandemic and educational inequalities

In our companion paper (Haeck and Lefebvre, 2020), we document the evolution of the achievement gap over time between low and high SES students using microdata from the Programme for International Student Assessment (PISA). PISA is a triennial survey of the skills of 15-year-olds in three domains: reading, math and science. Here, we present the average achievement gap by SES. To do so, we estimate the following equation for Canada and also for each province separately:

$$S_{i,py} = \alpha + \sum_{q=2}^{5} \beta_q SES_{q,i} + \delta X_i + \varepsilon_i \qquad (1).$$

$S_{i,py}$ is the PISA test score of student i in province p, it can be in math, reading or science in year y. The equation is estimated for each survey year, but also by pooling all survey-years and adding year fixed effects. The SES index is measured by the Highest International Socio-economic Index of Occupational Status (HISEI) and transposed in quintiles[1]. As a result, the term $SES_{q,i}$ represents four dummy variables, one for each of the top four quintiles of the HISEI index. The reference group is therefore the bottom quintile of the index, which represents students whose parents have the lowest occupational status. Following our companion paper, the quintiles are measured at the provincial level, but measuring them again at the national level provides extremely similar results. The vector X_i includes student gender, age in months, expected grade, along with a dummy for immigration status, and two dummies indicating the language used at home (French, English, and others as the reference). Plausible values and bootstrapped weights derived by the OECD are used in the estimation procedure (refer to PISA Technical reports for more information).

Table 1 present the estimated SES coefficient for Canada, for all survey-years (top panel), and also for 2018 only (bottom panel). Results from Table 1 suggest that, in reading, students with parents in the second quintile (Q2) of the SES index obtain an average score that is 21.3 points higher relative to students of Q1 parents. At the top end of the distribution, students of parents in the highest quintile (Q5) generally obtain 63.1 points more on average. The PISA Technical report (OECD 2010b) states that a 40 point difference in test scores is approximatively equivalent to one additional year of schooling. In this sense, the SES gap we identify represents more than a year of schooling. In math, the SES gradient is not as steep, from 19.2 points for Q2 relative to Q1, to 58.8 points for Q5 relative to Q1. Finally, in science we find a SES gradient starting at 18.1 in Q2 to 60.0 in Q5. Similar gradients are also observed in all ten provinces, with some variation across domains (see Figures 1 to 3). By 2018, the gradients are similar, slightly higher in magnitude but not statistically different.

Since school interruptions across the country due to the pandemic will be of at least 3.2 months (5.5 months in total minus a summer period of 2.3 months[2]), using Cooper et al.'s estimates, we can expect academic skills in reading and math to decrease by an additional 1.4 months,[3] which would represent about 6 points on average in PISA. As mentioned above,

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[1] This choice is explained in detail in Haeck and Lefebvre (2020).
[2] We do not include the summer months because these happen every year and are embedded in the observed gap.
[3] Negative impact of one month over 2.3 months of summer multiplied by an additional 3.2 months of school closure due to the pandemic.

Frenette (2008) finds that one less year of schooling is associated with a score that is 6 percent lower in reading, 5.9 percent lower in math, and 4 percent lower in science. Since the average PISA 2018 score in Canada was 520 in reading, 512 in math and 518 in science, an interruption of 3.2 months would represent a drop of 10 points in reading, 10 points in math and 7 points in science. Both studies lead to similar estimates.

As pointed out by Cooper et al. (1996), these average impacts may mask important differences by SES. Using SES estimates of Cooper et al. (1996) we find that students from low-income families may see their overall reading score decline by an additional 2 months (or -8 points), while other children may gain 3.2 months (or +12.8 points). This would increase the score gap between Q1 and Q5 students by 20.8 points, an increase of more than 30 percent relative to the actual SES gap in Canada. Since online teaching has taken place in some provinces, students have not been left completely idle. A drop of 30 percent may therefore be a worst case scenario. At the same time, given the differential access to technology and parental support by SES, it may also be a fairly realistic estimate.

More recently, Davies and Aurini (2013) study learning inequalities over the summer in Ontario. They also find evidence suggesting that socioeconomic disparities in literacy tend to increase over the summer. They find that children in affluent families gain literacy skills over the summer while those from the bottom SES quartile lose skills. According to their results, 25 percent of the observed skills gap by SES at the beginning of the school year is explained by differential summer learning by SES. Their results are in line with our above estimate for the pandemic.

On school perseverance, we can also expect a large negative impact. This is particularly worrisome in general, but even more so in provinces where the high school dropout rate is higher. On time completion rate is lowest in Québec.[4] This is also the province in which we noticed a larger fraction of 15-year-olds being in grade 8 in the PISA data. Major human and financial resources will be needed in the fall to help students persevere and succeed across the country, but it may be more severe in some provinces.

As a final note, we would like to point interested readers to Escueta et al. (forthcoming), a brilliant review of 126 studies on education technologies using controlled trials. The authors point out that the effectiveness of online learning is highest if combined with incentives to learn and interact. Teachers need to learn how to use technology to provide online teaching and they

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[4] Education Indicators in Canada: An International Perspective, 2018 (81-604-X).

need to provide retroaction to keep the students engaged. Teachers' responses will determine the depth of the impacts on the SES gap across the country. PISA 2021 survey data will be a valuable source to evaluate our successes and our failures.

3. Concluding remarks

Canada is one of the strongest performing countries in the OECD relative to education. However, these results mask important differences by SES. The pandemic brings important challenges to our provincial education systems. Our back-of-the-envelope calculation revealed that the SES score gap could increase by as much as 30 percent. School interruption is likely to impact perseverance in high school. A recent study on the polio pandemic showed that a few weeks of interruption at the beginning of the school year caused a significant reduction in school attainment among high school students.

While rising inequalities as a result of the pandemic should be our primary concern, we need to also remember that inequalities in academic achievement observed throughout the PISA surveys highlight a lingering issue that we will still need to address post-pandemic. Skills inequalities translate into income inequalities (e.g. Chetty et al. 2011). Furthermore, skills acquired early in life beget skills over the life cycle, and these skills in turn support our economic growth (e.g. Hanushek and Woessmann 2015a, 2015b; Carneiro et Heckman, 2003). Innovative actions across our education system will need to be taken to mitigate the potential rise in our achievement gaps by SES during the pandemic, but also beyond the pandemic.

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Table 1 : SES gradient in Canada

|	SES	Math		Reading		Science	
		Coef.	SE	Coef.	SE	Coef.	SE
All years	Q2	19.18	1.28	21.33	1.17	18.15	3.33
	Q3	31.44	1.23	35.05	1.24	35.48	3.46
	Q4	43.47	1.20	48.55	1.20	47.32	3.39
	Q5	58.79	1.36	63.12	1.42	59.97	3.55
2018	Q2	19.03	2.90	20.38	3.15	18.15	3.33
	Q3	35.50	3.55	38.05	3.45	35.48	3.46
	Q4	48.17	3.02	50.39	3.26	47.32	3.39
	Q5	62.17	3.42	62.66	3.56	59.97	3.55

Note : This table only presents the estimated coefficient on the SES quintile dummies. The top panel pools all survey-years together. The bottom panel is based on PISA 2018 data only. The reference group for the SES quintiles is Q1 (the bottom quintile including students whose parents have the lowest occupational status). Year fixed effects are included when all years are pooled together (top panel). All models include the following control variables : student gender, age in months, expected grade, a dummy for immigration status, and two dummies indicating the language spoken at home (French, English, and others as the reference).

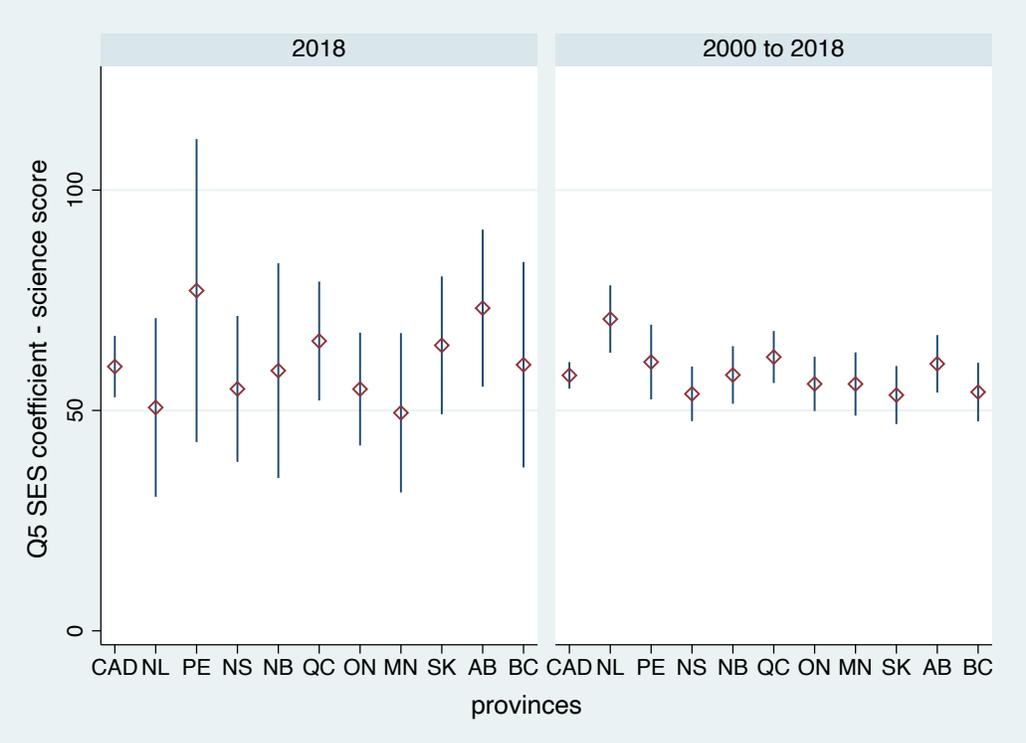Figure 1: Q5 versus Q1 SES gradient across Canada – Math score
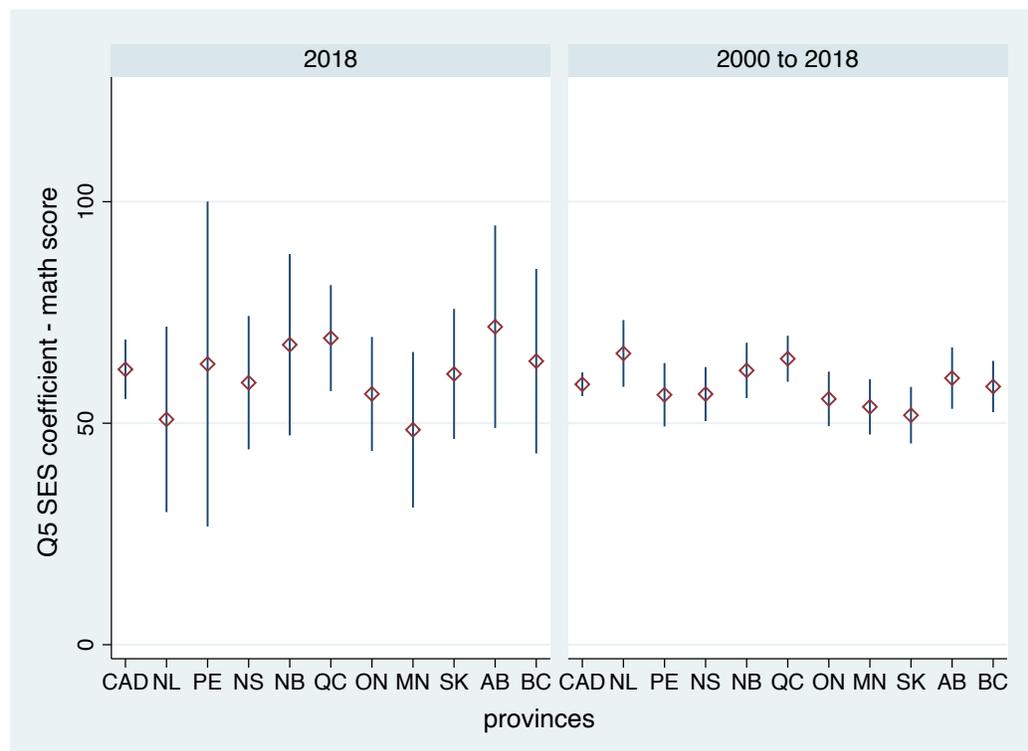
Notes : Estimated SES Q5 coefficients. See note Table 1 for list of control variables.

Figure 2: Q5 versus Q1 SES gradient across Canada – Reading score
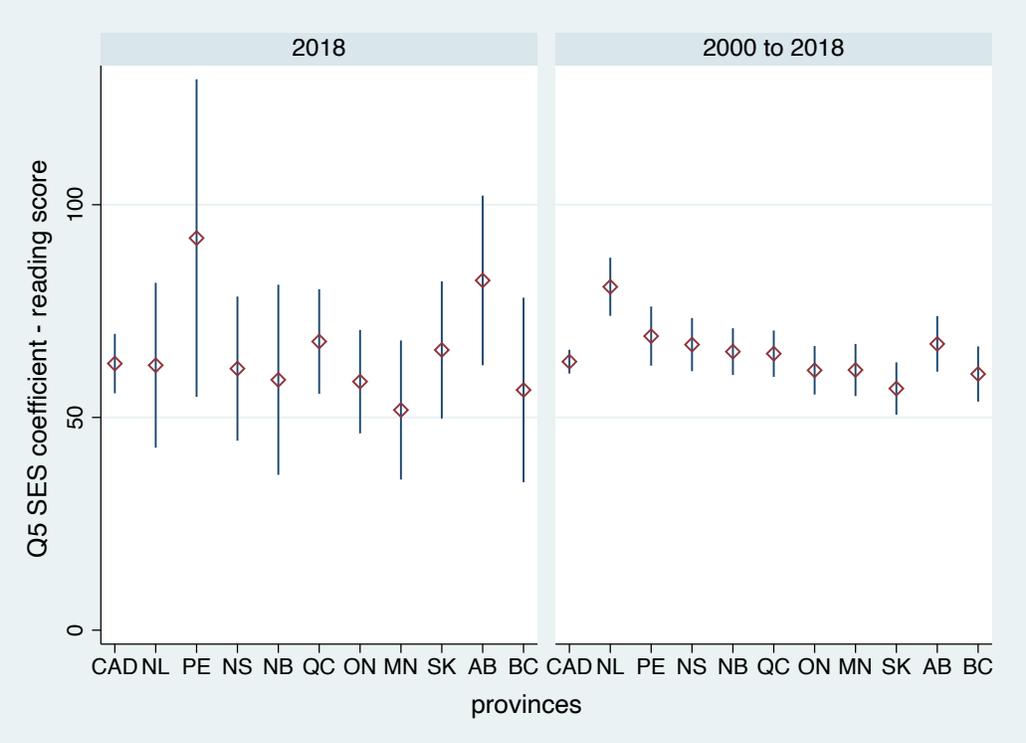
Notes : Estimated SES Q5 coefficients. See note Table 1 for list of control variables.

Figure 3: Q5 versus Q1 SES gradient across Canada – Science score

Notes : Estimated SES Q5 coefficients. See note Table 1 for list of control variables.