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The Effect of COVID-19 Learning Loss on Adult Outcomes

Building a Set of Age-Cohort Projections Using the Social Genome Model

Kristin Blagg

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The COVID-19 pandemic will likely leave a lasting mark on a generation of America's students, affecting their future earnings and educational attainment. Using the Social Genome Model (SGM), we project the effects of sustained learning loss on adult outcomes (i.e., at age 30) and on estimated lifetime income.

The SGM allows for the development of these estimates by four student cohorts: prekindergarten, elementary school (grade 3), middle childhood (grade 5), and early adolescence (grade 9) as well as by six groups based on sex and race or ethnicity. Broadly, we project that

- learning losses equivalent to spending three months out of school would lead to a loss of income at age 30 ranging from 0.7 to 3.5 percent and decrease lifetime earnings 0.4 to 2.0 percent;

- three months of learning loss would lead to modest declines in associate's degree attainment rates (0.01 to 0.06 percentage points) and larger declines in bachelor's degree attainment rates (0.18 to 0.89 percentage points);

- female students will experience larger losses of both income and degree attainment, relative to male students within the same racial or ethnic group;

- if students from low-income backgrounds experience larger learning losses than their higher-income peers, existing gaps in adult earnings would widen; and

- intensive elementary school interventions (for example, tutoring) could potentially remediate the effects of a three-month learning loss for prekindergartners.

Using the Social Genome Model to Project the Effects of COVID-19 Learning Loss

Since mid-March 2020, the COVID-19 pandemic has disrupted the education of American school children as schools have closed and instruction has quickly pivoted to remote learning. Even as some children reenter school in the fall of 2020, a large share of students are still learning remotely or in hybrid settings.[1] There is no existing template for calculating the long-run effects of this sustained and widespread disruption in learning.

In this brief, we use the SGM to assess how academic learning loss at four different life stages—prekindergarten (age 5), elementary school (grade 3 or age 8), middle childhood (grade 5 or age 11) and early adolescence (grade 9 or age 14)—may affect children's future degree attainment and incomes. Our approach, which uses matched longitudinal data from the Early Childhood Longitudinal Study-Kindergarten cohort and the 1997 National Longitudinal Survey of Youth, produces more nuanced insights than previous estimates of COVID-19 learning-loss effects (e.g., Hanushek and Woessman 2020) by allowing us to estimate the effects for four separate age cohorts and for six separate groups of students, divided by sex and by race or ethnicity. We also consider the implications of potentially larger learning losses for those who come from lower-income backgrounds (i.e., with family income below 200 percent of the federal poverty level).

These results provide policymakers and educators with a more complete framework for assessing how learning loss might affect students' long-run trajectories. Specifically, we project the effect of COVID-19 learning loss on earnings at age 30, lifetime income, and attainment of associate's and bachelor's degrees. Importantly, our model also allows us to incorporate the effects of remedial interventions later in the life course, showing how strong academic interventions, such as tutoring, might ameliorate learning loss.

Background and Advantages of the Social Genome Model

Early studies projecting the effect of the COVID-19 pandemic on long-term outcomes in the United States produce small but substantial estimates of GDP losses and individual income loss. Hanushek and Woessmann (2020) estimate that a loss of one-third of a school year could lead to a 2.5 to 4 percent loss in individual lifetime income. McKinsey researchers (Dorn et al. 2020) estimate that learning loss could lead to an additional 0.2 to 1.1 million students dropping out of high school and a 0.8 to 1.3 percent loss in GDP by 2040. Others (Azvedo et al. 2020) use data from 157 counties to estimate that the average individual lifetime income loss, in present value, could range from $6,472 to $25,680.

These estimates rely on previous studies of the relationship between levels of schooling or standardized test scores and life course outcomes, but we take a different approach. We use the SGM, a life cycle model of human development from birth to age 30 that is built by matching data from the Early Childhood Longitudinal Study-Kindergarten cohort and the 1997 National Longitudinal Survey of Youth. Using statistical matching and multiple imputation techniques, the matched panel dataset contains

information on 400,000 individuals. The SGM links children's status and outcomes at developmentally significant life stages to their outcomes later in life using linear regression models.[2] Thus, the model allows us to explore how factors early in a child's life, including cognitive, behavioral, and health outcomes, influence their later life outcomes, such as degree attainment and lifetime income.

In this brief, we focus on four adult outcomes: earnings at age 30, estimated lifetime earnings (net present value),[3] the attainment of an associate's degree by age 30, and attainment of a bachelor's degree by age 30. Estimates of lifetime earnings are based on the adult (age 30) relationships between an individual's education level, current adult income (and whether they have any income), and physical health, based on data from the Urban Institute's DYNASIM model.

Results from SGM COVID-19 Learning Loss Simulations

Assessing the Level of COVID Learning Loss

The amount of learning loss that US students might experience because of pandemic-related educational disruption is still largely unknown, and estimates vary widely.[4] There is no template for modeling how the conversion of the final three months of the 2019–20 school year to a largely remote format affected students, nor is there one for assessing the effect of modified in-person, hybrid, or remote learning in the 2020–21 school year.

For our estimates, we model an effect size roughly equivalent to three out-of-school months (assuming no schooling from March 15 to June 15). If remote schooling kept student learning on track and disruptions to a student's 2020–21 school year were minimal, we may be overestimating student learning loss. But for some students, this could be a substantial underestimate. In fall 2020, researchers estimated that 3 million students may not have received any formal education (in person or virtual) since mid-March (Korman et al. 2020). It is likely that the effects of the pandemic could be larger than what we model here.[5]

We use several sources of learning estimates to inform our view of the extent of learning loss over three months. First, we look at losses related to absenteeism and summer learning loss, as summarized and estimated by Kuhfeld and colleagues (2020). Although remote learning is not identical to either absenteeism or summer learning loss, these previous estimates help us assess how student learning might change during this period. We also look at the existing evidence on actual pandemic learning losses during the spring 2020 as measured for grade 6 students in Belgium (Maldonado and De Witte 2020) and for students in grades 4–7 learning remotely for eight weeks in the Netherlands (Engzell, Frey, and Verhagen 2020). We also use evidence on the expected annual gains in test scores by grade (as estimated by Hill et al 2007). We convert data from each of these sources into an estimate of the declines in test scores that could result from a three-month (60 school day) loss in schooling, by grade and subject (table A.1).

Existing projections of the long-term effects of the pandemic generally use a flat estimate of learning loss, irrespective of student age or grade. For comparability to these estimates, we estimate a flat loss,

equivalent to 0.3 standard deviations (SD) in mathematics and 0.2 SD in reading, across our four age cohorts. But studies using robust test score datasets from several grades (Kuhfeld et al. 2020; Hill et al. 2007) suggest that there are likely differences in the magnitude of learning loss by grade. Younger students tend to make more growth in SD test scores relative to older students, and they may lose substantially more ground when out of school or when instructional time or quality is reduced.

As a starting point for our analysis, we model two three-month learning loss scenarios: (1) a "flat" decline in math and reading scores with the same SD loss across all life stages; and (2) our preferred model, which uses a "larger losses earlier" decline in math and reading scores, with larger SD losses in earlier grades (table 1). [6]

TABLE 1

SGM Three-Month Learning Loss Simulations

Grade during pandemic	Same "Flat" SD Drop		Grade-Sensitive "Larger Losses Earlier" SD Drop	
	Mathematics	**Reading**	**Mathematics**	**Reading**
Kindergarten	-0.3 SD	-0.2 SD	-0.4 SD	-0.5 SD
Third grade	-0.3 SD	-0.2 SD	-0.2 SD	-0.2 SD
Fifth grade	-0.3 SD	-0.2 SD	-0.15 SD	-0.1 SD
Ninth grade	-0.25 SD		-0.075 SD	

Note: Our ninth-grade assessment is the Math and Verbal Armed Services Vocational Aptitude Battery estimates, which combine mathematics and reading tests.

If All Grades Experienced the Same Magnitude of Standard Deviation Learning Loss, Ninth-Grade Students Would See the Largest Declines in Adult Outcomes

Our results for the "flat" and "larger losses earlier" scenarios are very different. Should academic achievement decline consistently (i.e., by 0.2 SD in reading and 0.3 SD in mathematics) across our four life stages, students currently in ninth grade would experience the largest decreases in earnings at age 30 and lifetime income (figure 1). For that cohort of students, a test score decline of this magnitude is associated with a 3.5 percent decline in earnings at age 30 and a 2.0 percent decline in average lifetime income.[7] The same SD drop among the kindergarten cohort would yield a smaller 1.3 percent drop in age 30 earnings and a 0.7 percent drop in lifetime income. The third- and fifth-grade cohorts would experience a decline of 1.3 to 1.4 percent in age-30 earnings and a 0.8 percent decline in lifetime income.

The effect of academic performance losses has a stronger effect on the attainment of bachelor's degrees than on the attainment of associate's degrees: our model predicts smaller declines in associate's degree completion than bachelor's degree completion, even when accounting for the smaller share of individuals who achieve the degree. Nonetheless, for both associate's and bachelor's degree attainment, we find a pattern of educational attainment losses in the "flat" scenario that mirror our results for earnings (figure 1). If students across all age cohorts experience the same SD decline in test scores, we project that ninth-grade students would be 0.06 percentage points less likely to attain an associate's degree by age 30 and 0.89 percentage points less likely to attain a bachelor's degree.

These losses are smaller for younger grades in the "flat" model. For context, a 0.1 percentage point decline in bachelor's attainment, among the 2017–18 cohort of graduates, would be equivalent to a loss of about 1,980 degree holders,[8] and the same decline in associate's degree attainment would be equivalent to a loss of about 1,010 degree holders.

A Pandemic-Induced "Flat" Drop in Test Scores Would Most Affect Earnings and Attainment Outcomes for Ninth Grade Students
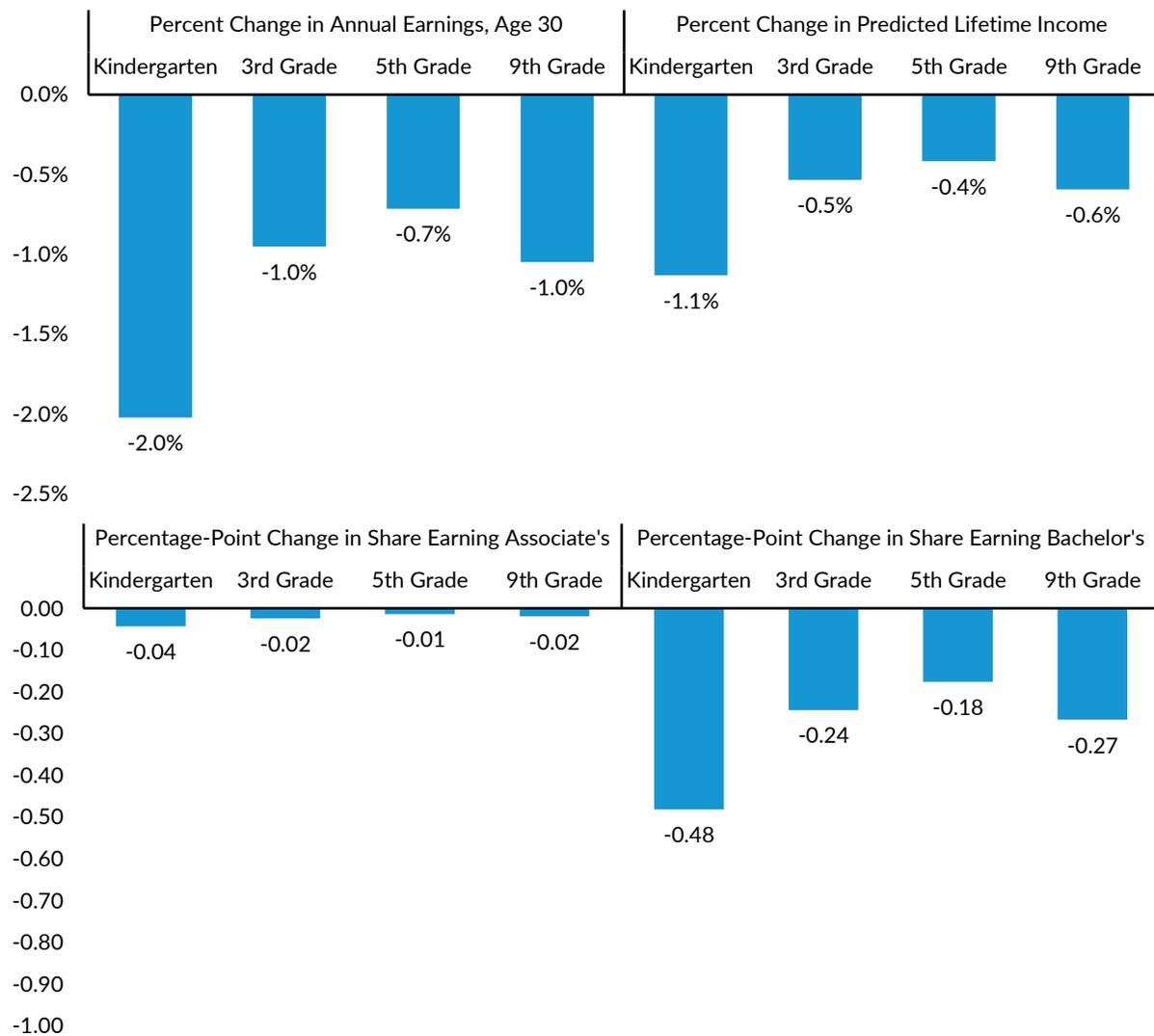

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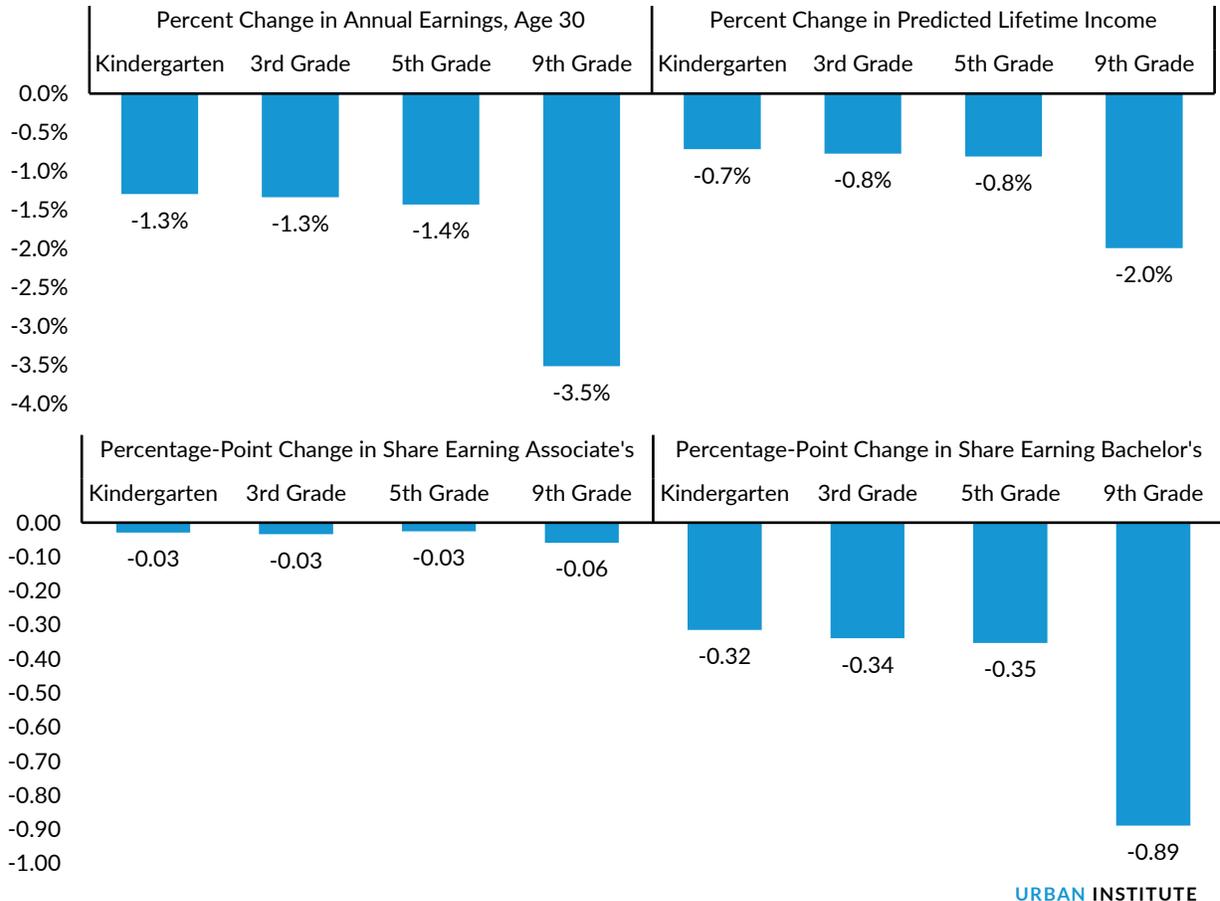
If Earlier Grades Experience Larger Standard Deviation Learning Losses, Kindergarten Students Would See the Larger Declines in Adult Outcomes

We see a different pattern in outcomes when we model larger SD declines in test scores for younger grades. Implementing an evidence-informed "larger losses earlier" decline in test score outcomes, the kindergarten cohort is predicted to have the largest drop in age 30 earnings (2.0 percent) and lifetime income (1.1 percent; figure 2). These adult declines for the kindergarten cohort, while substantial, are smaller than what our ninth-grade cohort is predicted to have in the "flat" model. Older cohorts are predicted to have smaller decreases of about 1 percent in earnings at age 30 and 0.6 percent in lifetime earnings (figure 2).

We see a similar pattern in the magnitude of adult educational attainment losses in our "larger losses earlier" model. Again, the effect of academic performance losses has a stronger effect on the attainment of bachelor's degrees than on associate's degrees. Losses in this model tend to be smaller and more broadly distributed across the cohorts. The kindergarten cohort is predicted to have the largest loss, at 0.04 percent points in associate's degree attainment and 0.48 percentage points in bachelor's degree attainment (equivalent to a loss of roughly 400 associate's degree holders and 9,500 bachelor's degree holders if scaled to the 2017–18 graduating cohort). Attainment losses among later cohorts are about half the size of the kindergarten loss.

A "Larger Losses Earlier" Drop in Test Scores Would Most Affect Earnings and Attainment Outcomes for Kindergarten Students

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THE EFFECT OF COVID-19 LEARNING LOSS

Although most current projections of the effect of pandemic-related learning loss build an estimate of long-term outcomes based on a single standard-deviation test score loss, we find that the same SD effect produces different results for different grade cohorts. Moreover, based on evidence of student test score growth at different ages, we expect that the amount of pandemic-related learning loss will be larger among younger cohorts. From this point forward we will use the "larger losses earlier" model because we believe it will more closely reflect the actual distribution of learning losses.

Women Are Predicted to Experience Steeper Declines in Adult Outcomes Than Men

One of the advantages of the SGM model is the ability to assess relationships separately by sex and race or ethnicity (in this analysis, we use the categories Black, non-Hispanic; Hispanic; and non-Black, non-Hispanic, or "all other"). By allowing associations between life outcomes to vary by these six groups, we allow for the possibility that relationships differ between outcomes across life stages based on sex and race or ethnicity. These differences may be related to a multitude of external social factors, such as structural discrimination, as well as affected by personal preferences.

When we look at "larger losses earlier" outcomes separately for each group and life stage, we see that the timing of learning loss influences outcomes for Black people differently than for non-Black people (figure 3). A pandemic-induced academic decline in early adolescence has a muted effect on lifetime income for non-Black adults relative to the cohort in prekindergarten. However, we find a different relationship for Black adults, where a decline in academic outcomes in ninth grade— even the small one we model—has a roughly equal or larger effect on lifetime earnings than a large drop in academic outcomes in prekindergarten. One interpretation of this result is that Black adolescents, on the cusp of applying for college or employment, may not be able to recover from a pandemic-induced learning loss as quickly as non-Black adolescents. For example, educational institutions and employers may apply stricter scrutiny to Black individuals relative to their peers.

Across all life stages, a decrease in academic outcomes generally reduces the lifetime income of women more than men, especially when compared with their peers of the same race or ethnicity. For example, Hispanic women are projected to experience a decrease in lifetime income that is roughly 50 percent larger than for Hispanic men at every life stage. This aligns with previous literature that indicates that cognitive and academic skills are a stronger predictor of adult earnings for women than for men (Lin et al. 2016; Watts 2020).

Our estimate of lifetime income is calculated using an individual's highest educational attainment at age 30 (high school diploma, associate's degree, or bachelor's degree), their health, and their earnings at age 30. In particular, changes in educational attainment are not uniform across our six sex and racial or ethnic groups (table 2). Non-Black, non-Hispanic individuals see larger percentage-point declines in bachelor's degree attainment, given a decline in test scores, across all life stages. In contrast, we predict a slightly larger decline in associate's degree attainment among Hispanic individuals relative to other groups. And relative to their male counterparts, women are predicted to have steeper declines in both bachelor's and associate's degree attainment.

FIGURE 3

Compared with Male Peers in Their Racial or Ethnic Group, Women Have Steeper Predicted Decreases in Lifetime Income Because of COVID Learning Loss

Predicted percent decrease in lifetime income

■ Kindergarten ■ 3rd grade ■ 5th grade ■ 9th grade
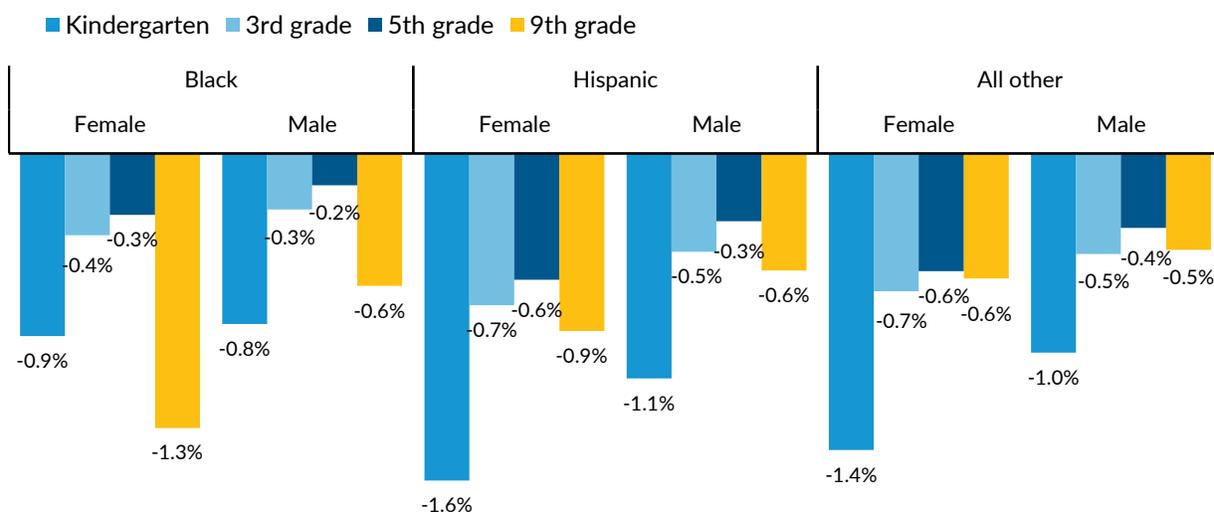
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TABLE 2

Hispanic Women Are Predicted to Experience Larger Declines in Associate's Degree Attainment

Non-Black, Non-Hispanic cohorts are predicted to experience the largest declines in bachelor's degree attainment

Share Earning Associate's Degree, Percentage-Point Decline					
		Kindergarten	3rd grade	5th grade	9th grade
Black	Female	-0.05	-0.02	-0.01	-0.04
	Male	-0.01	-0.01	0.00	-0.01
Hispanic	Female	-0.14	-0.09	-0.03	-0.04
	Male	-0.03	-0.02	-0.01	-0.02
All other	Female	-0.04	-0.02	-0.01	-0.01
	Male	-0.03	-0.02	-0.01	-0.02
Share Earning Bachelor's Degree, Percentage-Point Decline					
		Kindergarten	3rd grade	5th grade	9th grade
Black	Female	-0.29	-0.10	-0.05	-0.19
	Male	-0.08	-0.04	-0.03	-0.07
Hispanic	Female	-0.18	-0.10	-0.09	-0.14
	Male	-0.15	-0.08	-0.05	-0.09
All other	Female	-0.70	-0.37	-0.27	-0.39
	Male	-0.61	-0.30	-0.22	-0.30

Larger Academic Declines Among Low-Income Students Are Associated with Wider Gaps in Earnings Outcomes

In addition to concerns about pandemic learning loss broadly, many fear that students from low-income families will experience steeper learning losses than their higher-income peers. Low-income students may be less likely to have technology to access to virtual lessons, may be more likely to live in crowded households, and may have parents that are less able to support them in their learning (e.g., because of jobs that take them outside the home during the school day, because they speak a native language other than English, or because they cannot access costly resources such as private school or learning "pods"; Blagg et al. 2020).

Students from low-income areas are roughly half as likely as peers from higher-income areas to engage in online learning (Chetty et al 2020; Bacher-Hicks et al 2020). Emerging evidence from pandemic-related school closures indicates that low-income students are losing more ground academically. The study of Belgian Flemish schools indicates that students from lower socioeconomic status families experienced larger declines in academic achievement than students from higher-socioeconomic-status families (Maldonado and De Witte 2020). Among students in the Netherlands, students with parents who had lower education levels experienced a loss 40 percent larger than experienced by peers with more-educated parents (Engzell, Frey, and Verhagen 2020).

In our simulations, we look at what would happen if students from low-income families (those from a household with income at or below 200 percent of the federal poverty level) experienced a decline in test scores that was 30 percent larger than their higher-income peers. We continue to use the "larger losses earlier" model. For example, we estimate that low-income students in kindergarten have their achievement scores lowered by -0.52 SD in math and -0.65 SD in reading (relative to -0.4 and -0.5 for higher-income students).

These simulations indicate some widening of gaps between low- and higher-income children in age-30 earnings and in lifetime income gaps (table 3). For example, if ninth graders from families with lower incomes experience steeper declines in learning than their peers from higher-income families, we expect the gap in age-30 earnings to widen 0.6 percentage points. The impacts of different learning loss based on family income on adult earnings gaps are more pronounced for children in kindergarten and ninth grade then for those in third and fifth grade, for women than men, and for Black and Hispanic people than for those of other races and ethnicities.

Our model indicates a gap in associate's and bachelor's degree attainment between low- and higher-income students would remain roughly the same (or narrow) even when low-income students are predicted to have steeper academic declines from pandemic-related learning loss (table 4). We believe this may be a function of the base levels of attainment in our model. Students from higher-income backgrounds are more likely, in our dataset, to attain higher education. When modeling negative outcomes, a person in our data who did not attain a degree still does not attain a degree, while a person with a degree is given a decreased likelihood of obtaining that degree. Our model acts to reduce observed attainment in higher education, which tends to "pull down" a higher share of higher-income students, even when the academic loss is steeper for low-income students.

TABLE 3

When Low-Income Students Experience More Learning Loss, Adult Earnings Gaps Tend to Widen

		GAP IN EARNINGS AT AGE 30, RELATIVE TO CLASSMATES FROM HOUSEHOLDS ABOVE 200% OF THE FEDERAL POVERTY LEVEL				
			Percentage-Point Change in Gap			
		Current gap	Kindergarten	3rd grade	5th grade	9th grade
Black	Female	37.9%	1.1	0.5	0.4	1.7
	Male	31.4%	0.9	0.3	0.3	0.8
Hispanic	Female	28.1%	1.5	0.6	0.5	0.7
	Male	18.6%	0.6	0.2	0.1	0.2
All other	Female	31.1%	1.3	0.6	0.5	0.5
	Male	18.0%	0.4	0.2	0.2	0.2
All observations		31.7%	0.8	0.8	0.3	0.6

		GAP IN PREDICTED LIFETIME INCOME, RELATIVE TO CLASSMATES FROM HOUSEHOLDS ABOVE 200% OF THE FEDERAL POVERTY LEVEL				
			Percentage-Point Change in Gap			
		Current gap	Kindergarten	3rd grade	5th grade	9th grade
Black	Female	26.6%	0.1	0.0	0.0	0.3
	Male	27.0%	-0.4	-0.1	-0.2	-0.3
Hispanic	Female	24.5%	0.4	0.2	0.1	0.2
	Male	19.5%	0.3	0.0	0.0	0.1
All other	Female	27.0%	0.4	0.2	0.1	0.2
	Male	21.4%	0.0	0.0	0.0	0.0
All observations		32.0%	0.1	0.1	0.0	0.1

TABLE 4

Attainment Gaps Stay the Same or Narrow Even If Low-Income Students Experience More Learning Loss than Higher-Income Peers

		PERCENTAGE-POINT GAP IN ASSOCIATE'S DEGREE ATTAINMENT, RELATIVE TO CLASSMATES FROM HOUSEHOLDS ABOVE 200% OF THE POVERTY LINE				
			Change in Predicted Gap, Given Cohort			
		Current Gap	Kindergarten	3rd grade	5th grade	9th grade
Black	Female	0.16	-0.01	0.00	0.00	0.01
	Male	3.74	0.01	0.00	0.00	0.00
Hispanic	Female	1.10	-0.03	0.02	0.01	0.01
	Male	4.57	0.01	-0.01	0.00	-0.01
All other	Female	0.84	-0.01	0.00	0.00	0.01
	Male	0.38	0.00	0.00	0.00	0.00
All observations		1.70	0.02	-0.02	0.01	0.00

		PERCENTAGE-POINT GAP IN BACHELOR'S DEGREE ATTAINMENT, RELATIVE TO CLASSMATES FROM HOUSEHOLDS ABOVE 200% OF THE POVERTY LINE				
			Change in Predicted Gap, Given Cohort			
		Current gap	Kindergarten	3rd grade	5th grade	9th grade
Black	Female	19.48	-0.25	-0.09	-0.04	-0.17
	Male	12.75	-0.08	-0.03	-0.03	-0.07
Hispanic	Female	17.58	-0.12	-0.07	-0.05	-0.09
	Male	10.38	-0.09	-0.05	-0.03	-0.06
All other	Female	23.10	-0.30	-0.16	-0.12	-0.17
	Male	21.60	-0.36	-0.18	-0.13	-0.18
All observations		23.44	-0.40	-0.40	-0.20	-0.15

Exploring the Potential for Remediation after the COVID-19 Pandemic

Policymakers are already working to understand how learning loss could be remedied once students and teachers are fully back in school without fear of contracting COVID-19. One approach, already embraced by policymakers in England, is to implement widespread tutoring.[9] Tutoring is acknowledged by researchers to have a strong effect on academic outcomes (Nickow, Oreopoulos, and Quan 2020; Fryer and Noveck 2017).

Prior research suggests that tutoring could improve math achievement by 0.38 SD and reading achievement by 0.35 SD (Nickow, Oreopoulos, and Quan 2020). We look at the effect of a three-month disruption in kindergarten learning followed by a tutoring intervention that boosts attainment by this amount in by third grade.

Our results indicate that an intervention with an effect size similar to tutoring, implemented by third grade, could substantially reduce the effects of a loss in learning outcomes in prekindergarten (figure A.2). But these losses are not fully eliminated when we use our "larger losses earlier" model. With kindergarten declines of 0.4 SD in math and 0.5 SD in reading, we observe slight increases in associate's and bachelor's degree attainment among Hispanic students but small declines in attainment in other groups as well as small declines in lifetime income among all groups.

Note that Black students, particularly Black women, make up less ground, in terms of outcomes, relative to their non-Black peers. For example, without the intervention, Black girls who are in kindergarten are predicted to be 0.29 percentage points less likely to attain a bachelor's degree, and non-Black, non-Hispanic girls are predicted to be 0.70 percentage points less likely. With our elementary intervention, this result is flipped: Black girls end up losing more in terms of predicted bachelor's attainment (0.092 percentage points less likely, compared with 0.012 for non-Black, non-Hispanic girls). This result indicates that very early academic gains may be particularly important for adult outcomes within this group.

The COVID-19 Pandemic Will Have a Lasting Effect on School-Age Children

The COVID-19 pandemic has generated a substantial disruption in K–12 education that will likely affect future earnings and attainment, especially bachelor's degree attainment. Our SGM simulations indicate that the size of the learning loss matters: the same SD decline in test scores has a larger effect for those experiencing the pandemic in ninth grade versus in kindergarten. However, we expect learning losses to be greater among younger students for any given amount of time out of school. When we allow losses to be staggered by age, our projections of the effect of learning losses on longer-term earnings and income are more similar across age groups. Our model also indicates that adult outcome declines are likely to be larger for women than for men and that long-run effects somewhat vary by race and ethnicity as well as by age cohort. If lower-income students see more

learning loss than higher income students, we project a widening gap in earnings between low-income students and their higher-income peers, even though our model does not predict a widening gap in educational attainment.

Many unanswered questions remain about the pandemic's long-term effects on child outcomes. We've explored one of the more immediate concerns that policymakers have—the effect of academic achievement declines on adult outcomes—but we may explore many other pandemic effects in future work with the SGM. For example, socioemotional indicators (such as outcomes on peer and parent relationships, as well as externalizing and delinquent behavior) have been held constant in our academic outcomes model. But because much of a child's socialization occurs in school and in relationships with other children, we may also want to model the effect of a prolonged absence from school using these factors. Finally, there are early indications that undergraduate enrollment, particularly community college enrollment, has declined for the 2020–21 school year. Should this decline in enrollment lead to a decrease in higher educational attainment for young adults, the SGM would be able to model this effect as well. And of course, should academic learning losses be larger or distributed differently than what we model here, we can revisit these projections over time.

Appendix: Additional Tables

SGM Model Estimate of Student Learning Loss

			Estimated Standard Deviation Loss, Three Months					SGM Model	
SGM life stage	Grade	Subject	Absenteeism drop (Kuhfeld 2020)[a]	Belgian COVID-19 drop (Maldonado and De Witte 2020)[b]	Netherlands COVID-19 drop (Engzell et al. 2020)[c]	Summer Slide drop (Kuhfeld 2020)[c]	School Year drop (Hill et al. 2007)	"Flat" drop estimate	"Larger losses earlier" estimate
PreK	K	Math					-0.360	-0.30	-0.40
-	1	Math					-0.325	-	-
-	2	Math					-0.281	-	-
Elem	3	Math	-0.345			-0.287	-0.164	-0.30	-0.20
-	4	Math	-0.345		-0.120	-0.280	-0.177	-	-
MC	5	Math	-0.345		-0.120	-0.361	-0.129	-0.30	-0.15
-	6	Math	-0.345	-0.190	-0.120	-0.179	-0.095	-	-
-	7	Math	-0.345		-0.120	-0.127	-0.101	-	-
-	8	Math					-0.069	-	-
Eadol	9	Math					-0.079	-0.30[d]	-0.10[d]
-	10	Math					-0.044	-	-
-	11	Math					-0.003	-	-
PreK	K	Read					-0.480	-0.20	-0.50
-	1	Read					-0.306	-	-
-	2	Read					-0.189	-	-
Elem	3	Read	-0.210			-0.415	-0.114	-0.20	-0.20
-	4	Read	-0.210		-0.120	-0.320	-0.126	-	-
MC	5	Read	-0.210		-0.120	-0.299	-0.101	-0.20	-0.10
-	6	Read	-0.210	-0.290	-0.120	-0.247	-0.073	-	-
-	7	Read	-0.210		-0.120	-0.148	-0.082	-	-
-	8	Read					-0.076	-	-
Eadol	9	Read					-0.060	-0.20[d]	-0.05[d]
-	10	Read					-0.060	-	-
-	11	Read					-0.019	-	-

Notes: SGM = Social Genome Model. Cells are blank where data are not applicable.

[a] Estimates were aggregated by Kuhfeld et al. (2020) from the following three studies: Liu, Lee, and Gershenson (2020); Gershenson, Jacknowitz, and Brannegan (2017); and Aucejo and Romano (2016).

[b] Estimates based on Dutch assessments. Maldonado and De Witte (2020) note that 19 percent of students in their sample did not speak Dutch at home.

[c] Estimates were calculated based on an analysis of 5 million students who were assessed on Measures of Academic Progress Growth between the 2017–18 and 2018–19 school years.

[d] Indicates mathematics and reading scores that informed ASVAB estimate.

Effect of Elementary Intervention

		-0.4 SD in Mathematics, -0.5 SD in Reading in Kindergarten, Remediated with Tutoring Intervention by Third Grade		
		Associate's degree attainment (percentage-point change)	Bachelor's degree attainment (percentage-point change)	Lifetime income (percent change)
Black	Female	-0.0195	-0.097	-0.11%
	Male	-0.0035	-0.015	-0.20%
Hispanic	Female	0.2047	0.048	-0.09%
	Male	0.0036	0.074	-0.08%
All other	Female	-0.0033	-0.012	-0.08%
	Male	-0.0079	-0.048	-0.06%
All observations		0.0138	-0.017	-0.08%

Note: SD = standard deviation.

Notes

[1] Stephen Sawchuk, "Reopening America's Schools" A Snapshot of What It Looked Like in 2020–21," *Education Week*, September 23, 2020, https://blogs.edweek.org/edweek/District_Dossier/2020/09/school_reopening_plans_full_sample.html.

[2] See the SGM technical documentation from Werner and Blagg (2021).

[3] Estimates of lifetime earnings are based on the adult (age 30) relationships between individual's education level, current adult income (and whether they have any income), and physical health, as projected by the Urban Institute's DYNASIM model. Because earnings trajectories tend to vary by gender, these relationships are developed separately for men and women.

[4] Matt Barnum, "How Much Learning Have Students Lost Due to COVID? Projections Are Coming In, but It's Still Hard to Say," *Chalkbeat*, October 6, 2020, https://www.chalkbeat.org/2020/10/6/21504195/covid-schools-learning-loss-projections-nwea-credo.

[5] The SGM is based on a linear regression model, and thus most results from the SGM tend to increase linearly with the scale of the intervention, but the adult outcomes we present sometimes vary from that pattern, because these outcomes are necessarily bounded (i.e., held at no lower than 0 percent probability and no higher than 100 percent probability) as values change. For example, an individual who did not obtain a bachelor's degree in the original data may be predicted to have a negative likelihood of attaining a degree. In this case, this individual still does not obtain the degree (i.e., their outcome is assessed as 0 in the mean, not as a negative probability). We generated a set of nine-month learning loss estimates and can provide these data upon request.

[6] The SGM is based on a linear regression model, and thus most results from the SGM tend to increase linearly with the scale of the intervention, but the adult outcomes we present sometimes vary from that pattern, because these outcomes are necessarily bounded (i.e., held at no lower than 0 percent probability and no higher than 100 percent probability) as values change. For example, an individual who did not obtain a bachelor's degree in the original data may be predicted to have a negative likelihood of attaining a degree. In this case, this individual still does not obtain the degree (i.e., their outcome is assessed as 0 in the mean, not as a negative probability). We generated a set of nine-month learning loss estimates and can provide these data upon request.

7   Even though this effect is more than twice as large as in other life stages and seems valid given research on effect sizes in later grades, the effect might be biased upward. Our data match is across the middle childhood - early adolescence life stages. Although individuals are matched on math score, it is possible that we may still be observing a small "data seam" effect, with a stronger association between an individual's own score and later-life outcomes than between their score and "matched" younger ECLS-K version.

8   "Table 318.10. Degrees Conferred by Postsecondary Institutions, by Level of Degree and Sex of Student: Selected Years. 1869–70 through 2029–30," National Center for Education Statistics, accessed December 3, 2020, https://nces.ed.gov/programs/digest/d19/tables/dt19_318.10.asp?current=yes.

9 Matt Barnum, "England Is Launching a National Tutoring Program. Could the U.S. Follow Suit?" *Chalkbeat*, August 10, 2020, https://www.chalkbeat.org/2020/8/10/21362664/england-national-tutoring-program-us-americorps-congress.

References

Aucejo, Esteban M., and Teresa Foy Romano. 2016. "Assessing the Effect of School Days and Absences on Test Score Performance." *Economics of Education Review* 55: 70–87.

Azvedo, João Pedro, Amer Hasan, Diana Goldemberg, Syedah Aroob Iqbal, and Koen Geven. 2020. *Simulating the Potential Impacts of COVID-19 School Closures on Schooling and Learning Outcomes: A Set of Global Estimates*. Conference edition. Washington, DC: World Bank Group.

Bacher-Hicks, Andrew, Joshua Goodman, and Christine Mulhern. 2020. "Inequality in Household Adaptation to Schooling Shocks: COVID-Induced Online Learning Engagement in Real Time." Working paper 27555. Cambridge, MA: National Bureau of Economic Research.

Blagg, Kristin, Erica Blom, Megan Gallagher, and Macy Rainer. 2020. "Mapping Student Needs during COVID-19." Washington, DC: Urban Institute.

Chetty, Raj, John N. Friedman, Nathaniel Hendren, Michael Stepner, and the Opportunity Insights Team. 2020. "How Did COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data." Working paper 27431. Cambridge, MA: National Bureau of Economic Research.

Dorn, Emma, Bryan Hancock, Jimmy Sarakatsannis, and Ellen Viruleg. 2020. "COVID-19 and Student Learning in the United States: The Hurt Could Last a Lifetime." New York: McKinsey & Company.

Engzell, Per, Arun Frey, and Mark Verhagen. 2020. "Learning Inequality during the COVID-19 Pandemic." College Park, MD: SocArXiv.

Fryer, Roland G., and Meghan Howard Noveck. 2017. "High Dosage Tutoring and Reading Achievement: Evidence from New York City." Working paper 23792. Cambridge, MA: National Bureau of Economic Research.

Gershenson, Seth, Alison Jacknowitz, and Andrew Brannegan. 2017. "Are Student Absences Worth the Worry in US Primary Schools?" *Education Finance and Policy* 12 (2): 137–65.

Hanushek, Eric A., and Ludger Woessmann. 2020. *The Economic Impacts of Learning Losses*. Paris: Organisation for Economic Co-operation and Development.

Hill, Carolyn J., Howard S. Bloom, Alison Rebeck Black, and Mark W. Lipsey. 2007. "Empirical Benchmarks for Interpreting Effect Sizes in Research." New York: MDRC.

Korman, Hailly T.N., Bonnie O'Keefe, and Matt Repka. 2020. *Missing in the Margins: Estimating the Scale of the COVID-19 Attendance Crisis*. Sudbury, MA: Bellwether Education Partners.

Kuhfeld, Megan, James Soland, Beth Tarasawa, Angela Johnson, Erik Ruzek, and Jing Liu. 2020. "Projecting the Potential Impacts of COVID-19 School Closures on Academic Achievement." EdWorkingPaper 20-226. Providence, RI: Annenberg Institute at Brown University.

Lin, Dajun, Randal Lutter, and Christopher J. Ruhm. 2016. "Cognitive Performance and Labor Market Outcomes." Working paper 22470. Cambridge, MA: National Bureau of Economic Research.

Liu, Jing, Monica Lee, and Seth Gershenson. 2020. "The Short- and Long-Run Impacts of Secondary School Absences." EdWorkingPaper 20-125. Providence, RI: Annenberg Institute at Brown University https://doi.org/10.26300/xg6s-z169.

Maldonado, Joana Elisa, and Kristof De Witte. 2020. "The Effect of School Closures on Standardised Student Test Outcomes." Discussion paper DPS20.17. Leuven, Belgium: KU Leuven.

Nickow, Andre, Philip Oreopoulos, and Vincent Quan. 2020. "The Impressive Effects of Tutoring on PreK-12 Learning: A Systematic Review and Meta-Analysis of the Experimental Evidence." Working paper 27476. Cambridge, MA: National Bureau of Economic Research.

Watts, Tyler W. 2020. "Academic Achievement and Economic Attainment: Reexamining Associations between Test Scores and Long-Run Earnings." *AERA Open* 6 (2): 1–16.

Werner, Kevin, and Kristin Blagg. 2021. *Social Genome Model 2.0: Technical Documentation and User's Guide*. Washington, DC: Urban Institute. https://www.urban.org/research/publication/social-genome-model-20-technical-documentation-and-users-guide.

About the Author

Kristin Blagg is a senior research associate in the Center on Education Data and Policy at the Urban Institute. Her research focuses on K–12 and postsecondary education. Blagg has conducted studies on student transportation and school choice, student loans, and the role of information in higher education. In addition to her work at Urban, she is pursuing a PhD in public policy and public administration at the George Washington University. Blagg holds a BA in government from Harvard University, an MSEd from Hunter College, and an MPP from Georgetown University.

Acknowledgments

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500 L'Enfant Plaza SW
Washington, DC 20024

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