

Beyond COVID-19: assessment of learning loss on human capital

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Beyond
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Abstract

Purpose – This study aims to investigate the effect of the COVID-19 pandemic on K-12 education using County level data.

Design/methodology/approach – The authors use County-level data and charts to look at enrollment, performance in different grade levels, poverty measures, access to internet, etc., to shed light on educational losses after the pandemic.

Findings – In remote education after the pandemic, access to the internet has emerged as the foundational element of educational equity. While declines in academic engagement during remote schooling affected many schools, the potential for learning loss was significantly higher in lower-income communities. A thorough examination of end-of-grade level assessment data revealed a concerning trend of declining Math and Language Arts performance post-pandemic.

Research limitations/implications – One of the major limitations that the authors have faced in this research is that the authors did not have access to the individual/household level data regarding the high-speed internet connection, household income, poverty level and other relevant socio-economic variables. That made it impossible to control for variables of interest, and hence a distinction between correlation and causation was not possible.

Practical implications – Learning loss implications can be potentially long-term and complex. Therefore, targeted and intentional interventions are essential to decrease the disparity gaps, increase resources and raise learning levels to exceed prepandemic outcomes. Such interventions can impact skill development and the potential for future economic success, both individually and collectively.

Social implications – The findings underscore the urgent need for targeted interventions to address the digital disparities intensifying learning loss in Clayton County, Georgia. Effective strategies must prioritize equitable access to internet resources and technology, particularly for students in high-poverty areas. By bridging these gaps, schools and communities can reduce the potential for long-term consequences of pandemic-induced learning loss and create pathways for a more equitable future in education.

Originality/value – The main idea of this paper is to compare and contrast the learning losses in K-12 education after the COVID-19 pandemic within neighboring counties and see if the digital divide and/or poverty had any impact on the extent of those learning losses.

Keywords Digital divide, Human capital, Covid-19, Remote learning, Economic consequences, Learning loss

Paper type Research paper

1. Introduction

Research indicates that the transition to virtual learning during the 2020–2021 COVID-19 academic year, has resulted in a large learning loss in primary and secondary education that

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can potentially disrupt human capital development for many years to come. To mitigate the impact of the pandemic, educational systems could develop and implement strategies aimed at minimizing and reversing the educational setbacks given that these learning losses disproportionately affect lower-income communities most significantly due to socio-economic factors such as a lack of adequate teaching resources, support, and internet access. The sooner such interventions are implemented, the better the results.

During the early months of the pandemic, a presentation by the Atlanta Regional Commissions noted from a 2020 McKinsey Global Institute report that 20% of students in low-income households without reliable internet access did not log on to attend class meetings and/or complete class work (Alexander and Carnathan, 2020). Among those most vulnerable to the long-run economic consequences of learning loss would be households with elementary school children and those without access to computers and/or broadband internet subscriptions. The goal of this research is to determine the degree of learning loss damage to Clayton County's human capital base and to see if such damage and its long-term consequences are reversible. The following section provides a brief review of available literature highlighting the effects of the COVID-19 pandemic on human capital development. Section 3 discusses the data sources, Section 4 summarizes the main results, Section 5 provides conclusions, and Section 6 includes the authors' insights on future research potential around this topic.

2. Literature review

The COVID-19 pandemic caused a considerable disruption globally in all facets of life. On March 15, 2020, the US adopted measures to prevent the spread of the COVID-19 virus by implementing shutdowns and transitioning to remote learning. Schools worldwide quickly transitioned students from in-person to remote learning formats as the 2020–2021 academic year experienced an unexpected shift with long-term implications for many schools and communities.

While remote learning is historically defined as “planned instruction delivered on a digital device that is intended to support learning” (Ferri *et al.*, 2020), researchers refer to the rapid shift from in-person to online learning experienced during the pandemic as emergency remote teaching (ERT) (Ferri *et al.*, 2020; Whittle *et al.*, 2020). Specifically, ERT is defined as a “temporary shift to an alternate instructional delivery mode due to crisis circumstances” (Hodges *et al.*, 2020). According to the literature, the main objective of ERT is to provide “temporary access to instruction and instructional support in a manner that is quick to set up and reliably available during an emergency” (Hodges *et al.*, 2020, p. 4). A distinct difference in the modes of instruction between online and ERT lies in the planned, supported and intentional educational ecosystem of online learning in contrast to the temporary nature of ERT in response to a crisis or emergency. The challenges faced by many school systems stemmed from adopting ERT as a short-term solution that unexpectedly extended into a long-term online learning structure while lacking the necessary mechanisms to implement ongoing online education.

In a study by Dorn *et al.* (2020), the authors note that the US educational system was not equipped to accommodate an extended shutdown as imposed by the COVID-19 pandemic. Some school systems did not have access to prepared plans or technological systems for long-term online learning. Research suggests that the learning loss experienced from ERT highlights several gaps, including the knowledge base for transitioning to and implementing effective practices for online teaching and learning (Johnson *et al.*, 2023). Disparities in online teaching knowledge and utilization also stem from variables such as socio-economic backgrounds, experience with online instruction, disproportionate access,

support for underrepresented demographics, adequate household technology infrastructure and internet connectivity (Johnson *et al.*; Reynolds *et al.*, 2022). According to Liu (2021), considerable gaps in access to digital devices, content and networks align with factors such as unequal income, geography and social status, further exacerbating existing learning challenges due to long-term ERT. In addition, learning loss experienced from ERT can potentially pose permanent, negative implications for students, impeding future human capital development.

According to Dorn *et al.* (2020), disparities increased across income levels during the shutdown, causing disproportionate learning loss with a potentially long-term impact on economic well-being and the US economy. In a 2020 study, Hanushek and Woessman examine the relationship between the amount of schooling received and the progress in learning, revealing that missing one-third of a school year could result in an 11% decrease in expected gains in test scores. The authors indicate that enhanced skills substantially increase earnings based on data from the OECD's Survey of Adult Skills (PIAAC), which links adult literacy and numeracy skills with labor market incomes. For example, in the US, a standard deviation increase in test scores would equate to a 27% rise in income. Based on these relationships, the study estimates that a reduction in learning by 11% could lead to a decrease in lifetime earnings by about 2.6%. This highlights the significant long-term economic risks associated with the educational setbacks from school closures. Lower-income students facing more critical challenges could experience more significant adverse impacts that could increase existing disparities.

Skills and competencies learned in the K-12 education structure are vital to workforce success long-term (Bowen and Shume, 2020; Hanushek and Woessmann, 2020). Incorporating workforce skills such as critical thinking, communication and STEM into K-12 education allows students to become workforce-ready. According to Delano and Hutton (2007), "Workforce and economic development is increasingly a K-12 issue, and trained human capital must be developed through a complex educational system" (p. 47). Over the past several decades, research has highlighted a national decline in workforce competencies (Reider *et al.*, 2016). In response, US educational systems began implementing curricula designed to develop skills such as critical thinking, comprehension, communication and STEM subjects of science, technology, engineering and math (Casey, 2012; Hanushek, 2014; Reider *et al.*, 2016). The COVID-19 pandemic halted and complicated these efforts and, in some cases, created further disparities within the educational system and future workforce development initiatives. With the integration of ERT, students had insufficient opportunities to engage in practical and authentic learning experiences that developed workforce readiness skills and competencies (Bowen and Shume, 2020). Research indicates that the same workforce readiness skills of cognitive and skill development, math and reading comprehension, communication, social, emotional, and motivational development significantly impacted post-pandemic learning deficiencies (Hanushek and Woessmann, 2020). These critical skill deficiencies are vital components of economic development.

While the efforts of school systems to maintain continuity of learning during an unprecedented era were valiant and, in many cases, uncharted, unintended implications of the prolonged impact of the COVID-19 shutdown also included the reduction of students' interaction and engagement with peers and teachers, thus, hindering opportunities workforce skill development and benefits gained through social and emotional learning (Atwell, 2023; Bowen and Shume, 2020).

Understanding the dynamics of student engagement in the context of the COVID-19 pandemic sheds light on the critical need during the pandemic to develop strategies to foster a supportive and engaging environment that increases motivation for learning and yields more

positive student learning outcomes. For example, a study by [Combette et al. \(2021\)](#) found that when middle school students identified a direct connection between math assignments and their future, they were more motivated to complete the assignments even in the ERT environment. This supports the idea that students can engage in any environment when encouraged through appropriate measures and motivational factors ([Combette et al., 2021](#)).

Proper motivation – including supporting technology and resources – influences learning outcomes, and existing research highlights the connection between learning outcomes, school participation and workforce development. Economies with a lower-skilled workforce threaten lower economic growth, and a lack of effective learning can negatively impact students' immediate and long-term opportunities ([Dorn et al., 2020](#); [Oster et al., 2021](#)). During the pandemic, over 1.5 billion students worldwide were impacted by K-12 and college closures in the spring of 2020, and by November 2020, nearly 12.8% of students worldwide were still out of school ([Harmey and Moss, 2023](#)). These numbers raise significant concerns about academic achievement, social and emotional learning, and workforce development.

The effectiveness of the learning process suffered a substantial decline due to various factors surrounding school closures during the COVID-19 pandemic ([Goulas and Megalokonomou, 2020](#); [Weathers et al., 2021](#)). For example, the critical development window for early childhood education was disrupted, leaving opportunities for consequences regarding the socio-emotional and motivational development of students due to a lack of contact with teachers and peers and the psychological effects of isolation and lack of engagement ([Hanushek, 2014](#); [Oster et al., 2021](#)). The pandemic's disruption of critical development opportunities for children created new challenges. Furthermore, it amplified existing disparities and gaps in access to quality education, as evidenced by assessment results and academic outcomes.

Learning loss was significant and widely variable among different school systems, highlighting education inequalities, with some assessments indicating as little as zero change and others demonstrating substantial declines comparable to a grade level in academic achievement. [Fahle et al. \(2023\)](#) Implications from learning loss significantly impacted students from low-income communities and socio-economic backgrounds ([Larsen, Helland and Holt, 2022](#)). This includes students in areas disadvantaged by a digital divide, such as households with limited access to reliable internet and broadband subscriptions ([Graves et al., 2021](#)). Existing research shows that students in households less able to support out-of-school learning faced more considerable learning loss than more advantaged peers ([Hanushek and Woessmann, 2020](#)).

Georgia districts also faced similar educational inequities during the pandemic, particularly with low-income communities experiencing a lack of technology, digital literacy, and academic support systems. Students in areas of higher poverty – typically determined by eligibility for free or reduced lunch programs – experienced a myriad of challenges that, unless addressed, can result in increased educational shortfalls ([Klosky et al., 2022](#)) with long-term implications for the economy. Persistent gaps in learning could significantly hinder students' academic progress and skill acquisition, creating a more considerable barrier to achieving and exceeding prepandemic learning levels.

This paper investigates the extent and implications of Clayton County Public School's learning loss due to the COVID-19 pandemic. The objective is to compare pre and post-pandemic loss outcomes to ascertain and assess the feasibility of implementing intentional measures to reduce additional long-term implications for human capital development.

3. Data and descriptive statistics

In this study, we used publicly available data provided by the Georgia Department of Education, the GA Governor's Office of Student Achievement and the Atlanta Regional

Commission. In addition, we have used Federal Reserve Economic Data, US Bureau of Labor Statistics, US Census Bureau, and Bureau Economic Analysis data as needed. While the primary approach for data exploration was through descriptive statistics, a regression analysis is essential particularly for controlling variables such as parents' income, parents' educational attainment, poverty and access to high-speed internet. We have not been able to access any individual/household-level data at this stage. This is one of the areas that the authors feel we could improve in our future studies to be discussed in Section 6.

The three Counties selected for this study are three adjacent urban counties, Clayton, Fayette, and Henry in south metro Atlanta. Despite being neighboring counties, they are very different in socio-economic characteristics, which makes this study more interesting. [Table 1](#) compares the population in these three counties. While Clayton County is the most populous among the three counties, Henry County is growing faster than the other two counties.

Looking at [Table 2](#), Fayette County is among the top five Counties in the state of Georgia with per capita personal income above the Georgia and the USA averages. However, Henry and Clayton Counties are both below the state and national averages.

[Table 3](#) shows the real GDP for these three counties. It shows that Clayton County has the largest real GDP, even after adjusting for population, which might be surprising, but there is an explanation. While there are many high paying jobs in Clayton County, many of those jobs are occupied by workers who commute from surrounding counties to Clayton County, hence, many of these high paying jobs do not translate into high personal income inside Clayton County.

[Table 4](#) illustrates the number of Supplemental Nutrition Assistance Program (SNAP) recipients in each County. Even after adjusting for population, Clayton County number of SNAP recipients are far larger than the other two counties. The jump in SNAP recipients between 2019 and 2020 is noticeable in all these three counties, which coincides with the COVID-19 pandemic.

[Table 5](#) displays the percentage of people under the poverty line in each of the three Counties. As expected, there is a strong correlation between the number of SNAP recipients and poverty in these three counties.

County	2019	2020	2021	2022
Clayton, GA	296,729	297,623	297,318	296,564
Fayette, GA	117,884	119,483	120,681	122,030
Henry, GA	237,063	241,848	245,023	248,364

Table 1.
Population (persons),
by county,
2019–2022

Source: Bureau of Economic Analysis (BEA)

County/State	2020	Per capita personal income			Percent change from preceding period		
		Dollars		Rank in state	Percent change	Rank in state	
		2021	2022	2022	2021	2022	2022
<i>United States</i>	<i>59,153</i>	<i>64,430</i>	<i>65,470</i>	–	8.9	1.6	–
<i>Georgia</i>	<i>51,469</i>	<i>56,184</i>	<i>56,589</i>	–	9.2	0.7	–
Clayton, GA	31,757	34,575	32,831	154	8.9	–5.0	155
Fayette, GA	68,059	72,745	75,294	5	6.9	3.5	22
Henry, GA	42,920	46,657	46,921	45	8.7	0.6	64

Table 2.
Per capita personal
income, by county,
2020–2022

Source: Bureau of Economic Analysis (BEA)

Table 3.
Real gross domestic
product, by county,
2019–2022

County/State	Real gross domestic product Thousands of chained (2017) dollars				Rank in state		Percent change from preceding period		Rank in state	
	2019	2020	2021	2022	2020	2022	2020	2021	2022	
<i>United States</i>	20,573,580,103	20,106,509,888	21,271,676,784	21,668,520,913	–	–	–2.3	5.8	1.9	–
<i>Georgia</i>	620,792,426	602,321,806	639,236,039	655,827,268	–	–	–3.0	6.1	2.6	–
Clayton	18,739,470	14,920,732	16,909,218	19,608,272	6	6	–20.4	13.3	16.0	9
Fayette	5,423,860	5,400,316	5,627,565	5,766,885	17	17	–0.4	4.2	2.5	65
Henry	6,753,532	7,014,885	7,531,645	7,735,480	14	14	3.9	7.4	2.7	63

Source: Bureau of Economic Analysis (BEA)

Table 6 compares the unemployment rates for the three Counties. The unemployment rate comparison is indeed in line with the other socio-economic indicators that are discussed above.

Based on the data that is discussed in this section, we conclude that these three counties are very different despite their very close proximity. These differences in socio-economic indicators make this study even more interesting. In the next section, we will review the main results.

4. Main results

For the longest time, physical attendance at an institution of learning was synonymous with education. The internet was the backchannel one could use to obtain additional educational resources outside of a physical location. Then the pandemic hit, and the immediate and unprepared shift to remote learning immediately made internet access synonymous with educational access.

We have used publicly available data from the Georgia Department of Education and focused on Clayton County, GA, one of the most populous counties in the State of Georgia

Year	Clayton	Henry	Fayette
2016	71,982	28,623	6,275
2017	72,160	28,261	5,812
2018	66,157	26,726	4,930
2019	66,484	27,389	5,002
2020	83,545	36,636	6,841
2021	73,719	34,516	6,032

Source: Federal Reserve Economic Data (FRED)

Table 4.
Annual SNAP
benefits recipients by
Georgia county,
persons, not
seasonally adjusted

Year	Clayton	Henry	Fayette
2016	23.3	8.0	4.8
2017	19.0	8.3	4.5
2018	20.1	5.9	3.8
2019	18.4	6.5	4.3
2020	19.9	6.7	4.0
2021	21.5	8.0	5.3
2022	17.2	6.4	4.7

Source: Federal Reserve Economic Data (FRED)

Table 5.
90% Confidence
interval upper bound
of estimate of percent
of people of all ages
in poverty by
Georgia county,
percent, annual, not
seasonally adjusted

Year	Clayton	Henry	Fayette
2019	4.4	3.7	3.1
2020	10.3	7.3	5.4
2021	6.3	4.2	2.9
2022	4.1	3.3	2.7
2023	4.1	3.5	3.0

Source: US Bureau of Labor Statistics (BLS)

Table 6.
Unemployment rates
by Georgia county,
percent, not
seasonally adjusted

(among the top five), and the two neighboring counties, Fayette and Henry Counties, for comparison purposes. Clayton State University is in Clayton County, GA.

Looking at the enrollment data before and after the COVID-19 pandemic (Figures 1–3), it is evident, with only a few exceptions for most of the grade levels across the three counties, the enrollment either remained almost the same or decreased after the COVID-19 pandemic. Possible contributing factors may include a family’s decision to withdraw from school or homeschool their children due to fear of COVID-19 transmission. Notably, for more than one year after the onset of the pandemic in the USA, there was no vaccine available, especially for young children. Data indicates that this adverse effect on enrollment is much more robust and pronounced for grades K-5. The literature also substantiates that the same group was the most vulnerable in the transition to online and virtual learning due to a lack of experience and immaturity. We will later examine the students’ Mathematics and Language

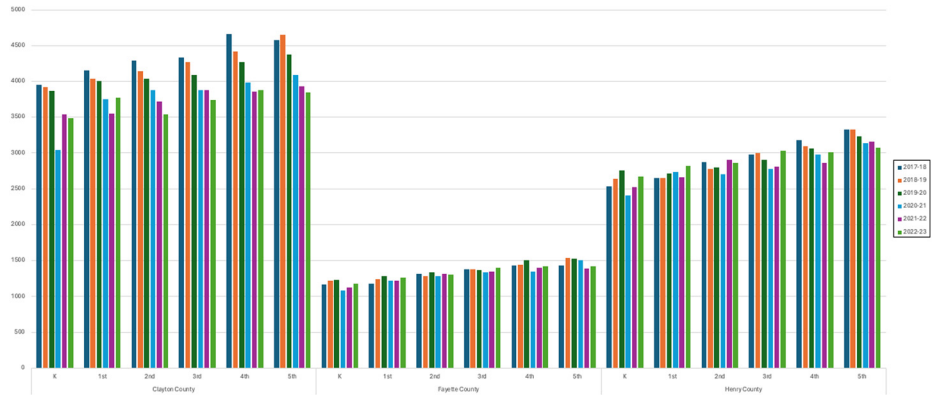


Figure 1.
Primary school enrollment before and after COVID-19 pandemic

Source: Georgia Governor’s Office of Student Achievement

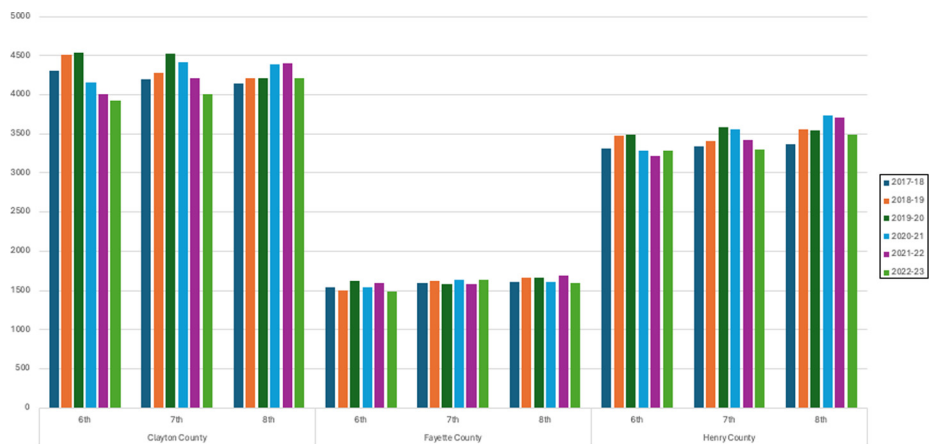
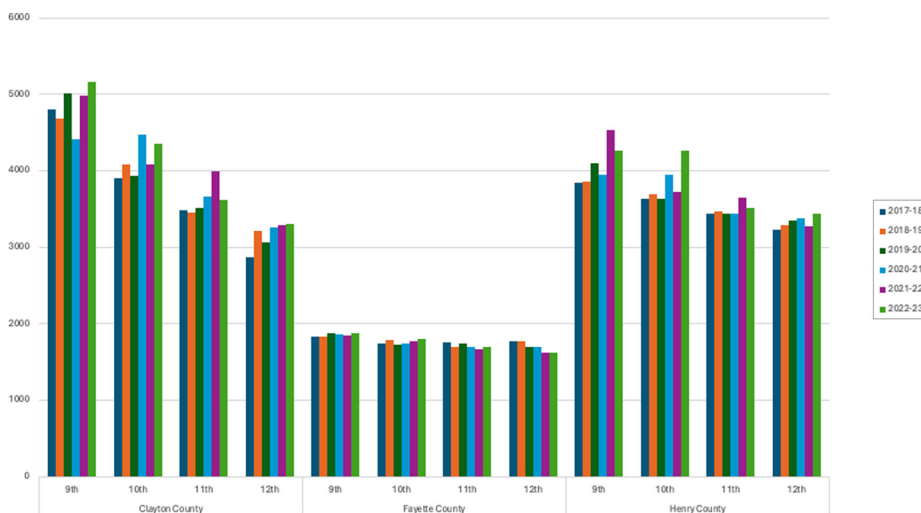


Figure 2.
Middle school enrollment before and after COVID-19 pandemic

Source: Georgia Governor’s Office of Student Achievement

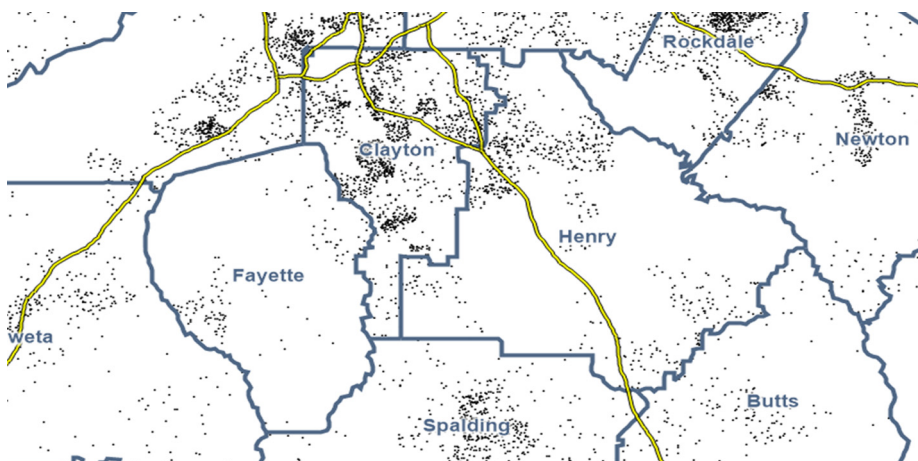


Source: Georgia Governor’s Office of Student Achievement

Figure 3.
High school enrollment before and after COVID-19 pandemic

Arts Assessment performance at different grade levels to look for such adverse effects. Indeed, the assessment data shows a decline in assessment results after the pandemic.

Pre-pandemic data on internet access by geographical area in the State of Georgia paints a vivid illustration of where students resided who were without an internet subscription or an internet-capable device. This data is provided by the American Community Survey and Atlanta Regional Commission. Lack of reliable internet access increased students’ vulnerabilities to educational loss during the pandemic. Figure 4, provided by the Atlanta Regional Commission, shows the density of households with students lacking an internet



Source: Atlanta Regional Commission (2020) American Community Survey five-year estimate

Figure 4.
Concentrations of households with children lacking internet access

subscription or an internet-capable device in 2020. High-poverty areas in Southwest Atlanta, South Fulton and Clayton County regions showed clusters of student populations without an internet subscription. Also included were additional urban areas within suburban counties like Cobb, Cherokee and Rockdale.

While only considering a student’s access to an internet subscription or an internet-mobile device, the Atlanta Regional Commission reported only a moderate correlation ($r = 0.35$) between the percentage of students living below the poverty line and percentage of students without an internet subscription or internet-mobile device. The following 2020 Atlanta Regional Commission map (Figure 5), providing a spatial comparison between poverty and student areas without internet access, aligns with this correlation.

A side-by-side comparison shows that the area northeast of the intersection of I-20 and I-75/85 has a dense population of children living below the poverty line but no corresponding concentration of children without internet access. However, the southeastern portion of DeKalb County has fewer children below the poverty line but a high density of children with no internet access.

Clayton County, the county of interest for this study, shows high-density levels of children living below the poverty line with high density levels of children without internet access in the same area. Data from Georgia Power (Figure 6) shows that the internet access percentage in Clayton County is lower than the US and GA average. Access to computers is higher than in both the US and GA; however, Clayton County trails behind, compared to Fayette and Henry counties.

Evidence of educational loss resulting from vulnerable access to internet services may likely be reflected in the end-of-grade proficiency exams in language arts and mathematics. Assuming younger students have less online learning and computer experience than older peers, data from the Georgia Governor’s Office of Student Achievement (Figures 7–11) show that third, fifth and eighth-grade level proficiency in language arts and mathematics declined more significantly for Clayton County – a high-poverty county–than its low-poverty neighboring counties, Fayette and Henry. The Georgia State Board of Education defines proficiency as the ability of the student to *demonstrate proficiency* in the knowledge and skills necessary at the current grade level/course of learning, as specified in Georgia’s content standards. Proficient students are deemed prepared for the next grade level or course and to be on track for college and career readiness.

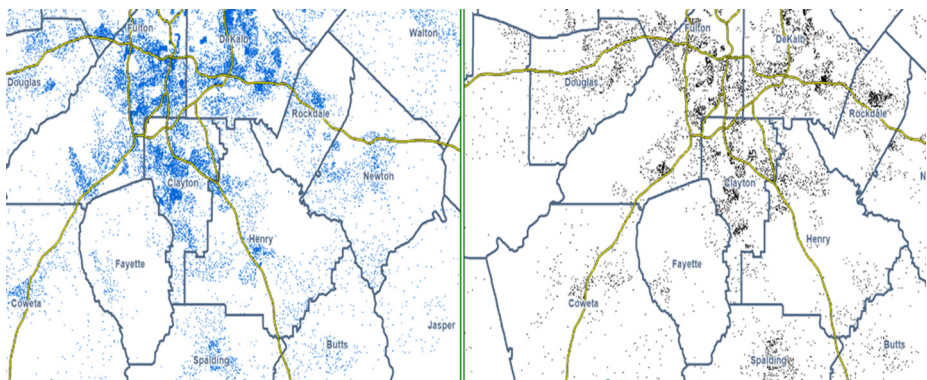


Figure 5.
Spatial correlation
between child
poverty (left) and
internet access (right)

Source: Atlanta Regional Commission (2020) American Community Survey five-year estimate

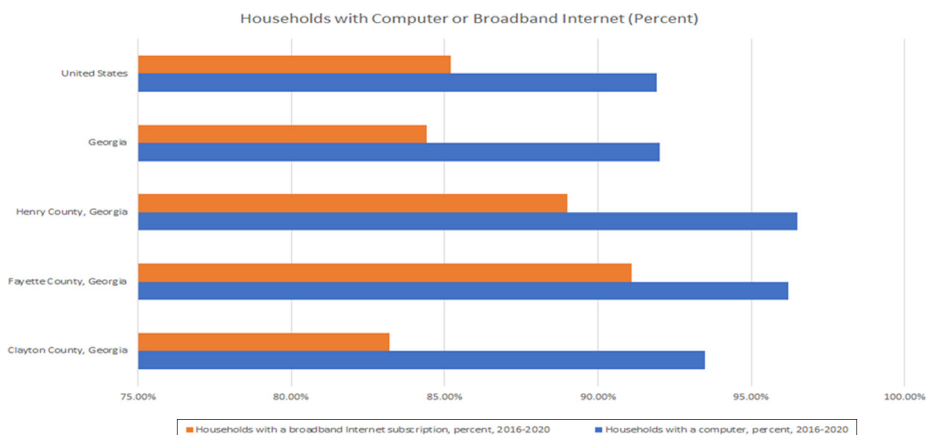


Figure 6.
Comparison of household's access to internet and computers across three GA counties

Source: Georgia power

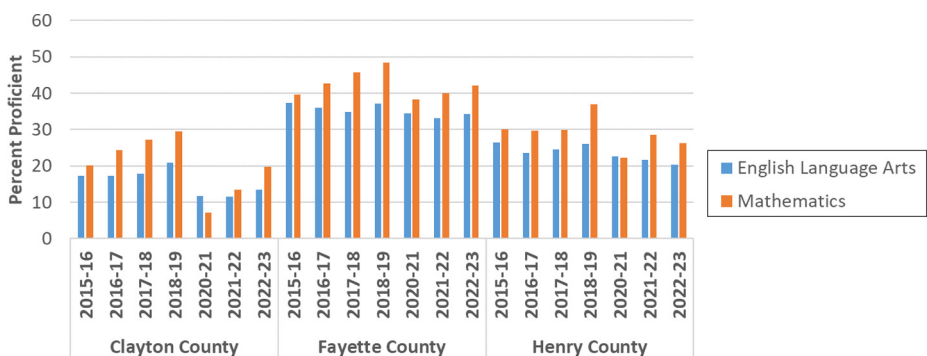


Figure 7.
Percent of third graders proficient in Language Arts and Math (2015-2023)

Source: Georgia Governor's Office of Student Achievement

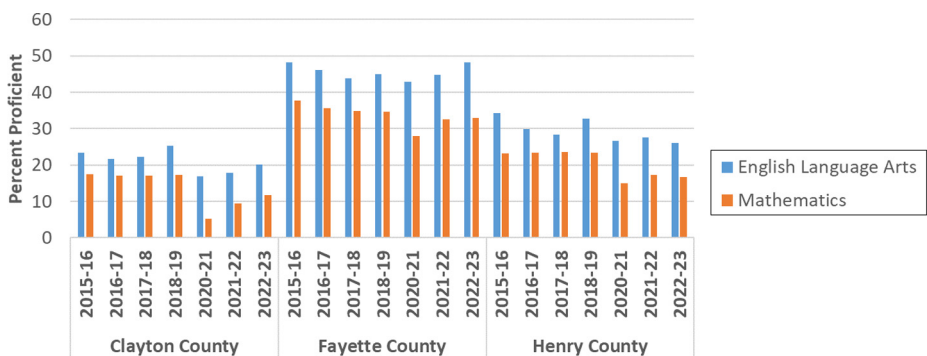


Figure 8.
Percent of fifth graders proficient in Language Arts and Math (2015-2023)

Source: Georgia Governor's Office of Student Achievement

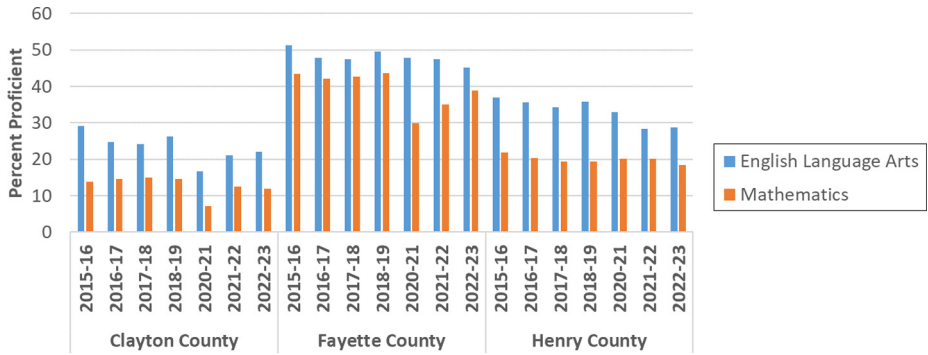
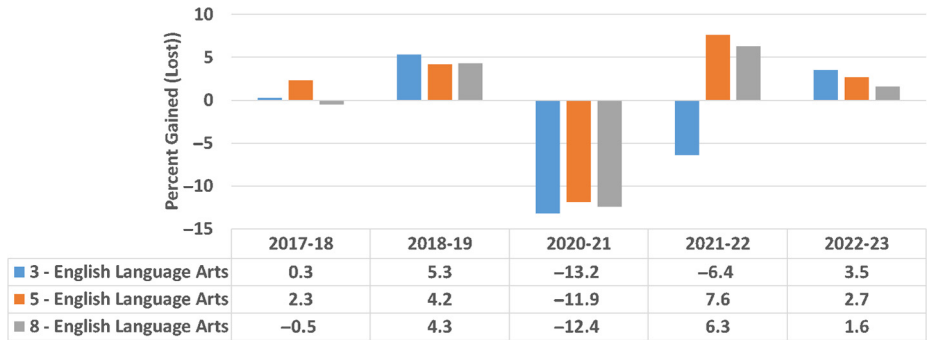


Figure 9.
Percent of eighth graders proficient in Language Arts and Math (2015–2023)

Source: Georgia Governor’s Office of Student Achievement

Figure 10.
Percent gained (lost) of Clayton County students testing proficient and higher on the Georgia English Language Arts milestones at the third, fifth and eighth grade levels



Source: Georgia Governor’s Office of Student Achievement

Despite the decline, the 2021–2022 and 2022–2023 school years show an upward trend in English and Mathematics proficiency levels but still short of pre-Covid proficiency levels. The recovery process is more prominent in Fayette – the more affluent County – among the three.

In 2021, with the return to primary schooling in a hybrid format of online learning and in-class instruction, the Atlanta Regional Commission (Figure 12) and the Georgia Governor’s Office of Student Achievement (Figure 13) reported the third-grade student population in Clayton County had the lowest participation rate in the third grade English Language Arts and Mathematics Assessments for that year.

Our analysis of the enrollment, proficiency in Math and Reading, access to high-speed internet and poverty discussed in this section align with the literature reviewed in Section 2. However, due to a lack of access to the household level data, some of these results may reflect correlation rather than causation and additional research is necessary to investigate further.

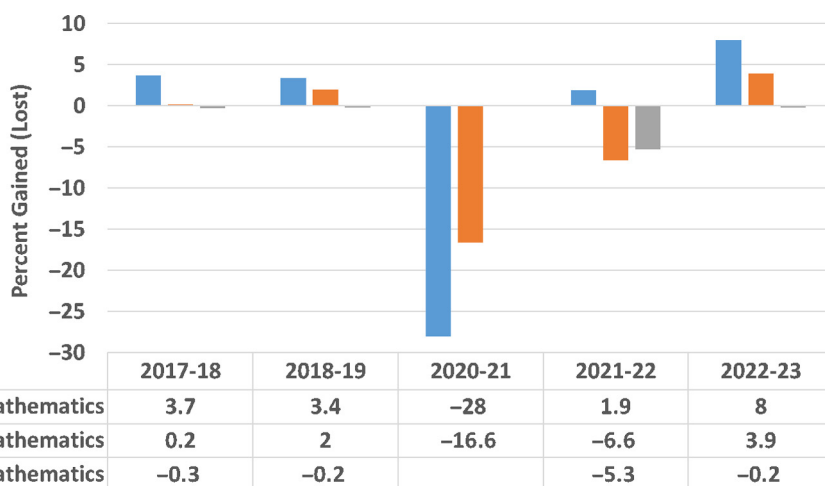


Figure 11. Percent gained (lost) of Clayton county students testing proficient and higher on the Georgia Mathematics milestones at the third, fifth and eighth grade levels

Note: In 2020–21, the total number of eighth-grade students taking the Georgia *Mathematics* milestones were too few to count to be a representative sample the results were not recorded
Source: Georgia Governor’s Office of Student Achievement

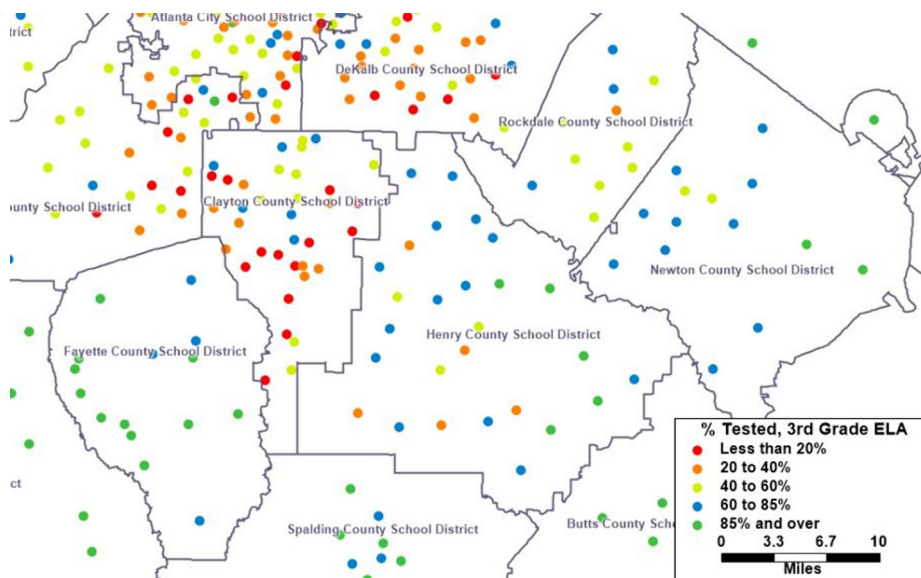


Figure 12. Participation rates in 2021 third grade – English language arts assessment

Source: Atlanta Regional Commission; Neighborhood Nexus

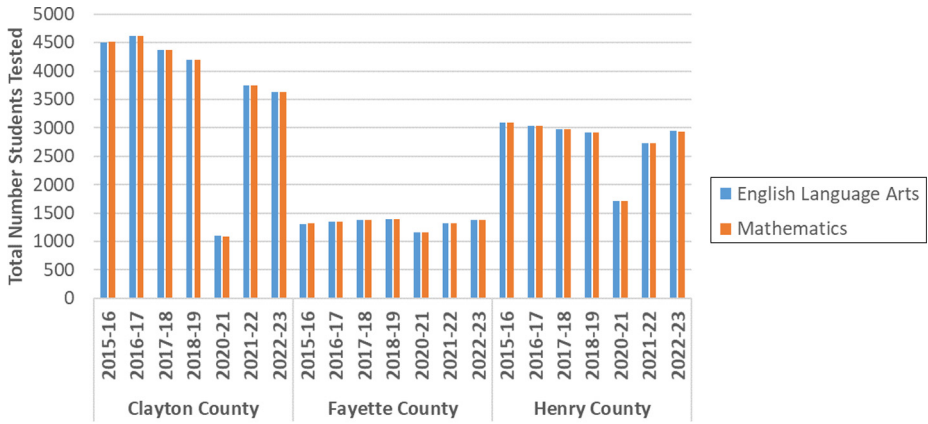


Figure 13. Participation rates for third grade – English language arts and math assessment (2015–2023)

Source: Georgia Governor’s Office of Student Achievement

5. Conclusion

The COVID-19 shutdown caused global disruption to K-12 students’ educational progress and vital skill development. Potential learning loss during the shutdown is linked to the accessibility of online resources and internet connection. In remote education, access to the internet has emerged as the foundational element of educational equity. While declines in academic engagement during remote schooling affected many schools, the potential for learning loss was significantly higher in lower-income communities.

Clayton County, GA – the county highlighted in this paper – mirrored challenges experienced by low-income and vulnerable communities, particularly academic inequities exacerbated by the digital divide and socioeconomic factors. Using data collected by the Georgia Department of Education, findings underscore Clayton County’s significance as one of Georgia’s largest student populations while highlighting disparities and limited resources that impeded learning opportunities during the pandemic.

A thorough examination of assessment data revealed a concerning trend of declining Math and Language Arts performance post-pandemic. End-of-grade proficiency exams served as vital benchmarks, highlighting the scale of learning loss, particularly in pivotal years such as third, fifth and eighth grades. Language Arts, Reading and Math assessments emerged as crucial indicators of these declines, offering a comprehensive view of their scope and impact.

Learning loss implications can be potentially long-term and complex. Therefore, targeted and intentional interventions are essential to decrease the disparity gaps, increase resources, and raise learning levels to exceed pre-pandemic outcomes. Such interventions can impact skill development and the potential for future economic success, individually and collectively. In addition, targeted interventions can increase the potential for positive human capital development. Addressing barriers such as the digital divide and socio-economic challenges requires a focus on improving access to reliable high-speed internet, opportunities for increased student learning support and steps toward equity among income levels.

The research further highlighted the profound influence of the absence of internet access on students’ vulnerability to learning loss. Clayton County, characterized by its high poverty rates, witnessed a disparity in internet access among its student population. This digital

divide was compounded by the presence of high-density areas with children living below the poverty line which was correlated with a significant representation of students lacking internet access within the same communities. The percentage of internet access in Clayton County is below national and state averages, further emphasizing existing educational inequities. Access to computers, another critical component of remote learning, posed additional challenges for students in the county.

These findings underscore the urgent need for targeted interventions to address the digital disparities intensifying learning loss in Clayton County. Effective strategies must prioritize equitable access to internet resources and technology, particularly for students in high-poverty areas. By bridging these gaps, schools and communities can reduce the potential for long-term consequences of pandemic-induced learning loss and create pathways for a more equitable future in education.

Improving educational outcomes involves a multifaceted approach that acknowledges the intersection of socio-economic disparities and academic outcomes. Such efforts aid in mitigating the impact of the digital divide and fostering an environment where students have opportunities for success while improving human capital potential.

Future research is needed to develop evidence-based, proactive strategies to help redirect the long-term effects of the pandemic on education and aim for a more equitable and prosperous future for students in Clayton County and similar communities.

6. Future directions and limitations

The authors are determining various next steps for future research in this area including possibly working with the Clayton County Public Schools System to disseminate, collect and analyze surveys. Survey results will help identify the best ways to:

- assess deficiencies in learning as consequences of the digital divide;
- identify target areas of need for students, teachers and families;
- develop strategies to decrease the digital divide; and
- follow students' progress in the recovery process over time.

This paper explores four main factors triggered by the COVID-19 pandemic that impacted learning loss in Clayton County, GA. The first factor explored pre- and post-pandemic enrollment data. The second area of focus included math and language arts assessment performance from primary and middle schools. The third factor analyzed data on high-speed internet access by geographic regions in three Georgia Counties. In contrast, the fourth factor examined correlations between various socio-economic variables that impacted resources and virtual learning preparedness in schools and households.

However, we did not have access to the individual/household level data regarding the high-speed internet connection, household income, poverty level and other relevant socio-economic variables. For example, if we obtain access to this data through an internet service provider or census bureau, we hypothesize that the correlation between poverty and lack of high-speed internet connection in Clayton County could be high. In addition, by controlling for variables of interest through a regression analysis, a distinction between correlation and causation might become possible.

One of the other limitations that we faced was the significant drop in the number of students who took the Georgia Milestones test immediately after the pandemic, specifically in Clayton County. Since those students who opted out were most likely the less prepared, the drop in the scores would have been more pronounced had more students taken the test.

Our bias is positive, meaning that we could potentially observe a more significant decline in overall test scores.

This analysis enriches the growing body of research that highlights the impact of the COVID-19 pandemic on education. Existing literature also emphasizes the need for interventions and strategies to reduce the effect of the pandemic on K-12 education. Additional literature and data monitoring are necessary to track the potential long-term implications of these disruptions on learning loss and human capital development. Future research on the COVID-19 impact on educational outcomes in Clayton County will need to:

- obtain Georgia milestones English, Language Arts and Mathematics scores for third through eighth grades at the individual level for students in Clayton, Fayette and Henry counties for 2015–2023 and beyond;
- determine if each student taking the Georgia milestones had household access to a computer and high-speed internet for the period of study; and
- determine if each student taking the Georgia milestones lived in a household below the Georgia poverty line or if their families were SNAP recipients.

Future research and literature may also provide evidence-based insight into the success of existing remediation strategies while pinpointing overlooked implications and improved approaches to educational outcomes and human capital potential.

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