THE IMPACT OF LACK OF INTERNET AND TECHNOLOGY ACCESS ON STUDENTS’ ACADEMIC ACHIEVEMENT: AN ANALYSIS OF THE UNITED STATES

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THE IMPACT OF LACK OF INTERNET AND TECHNOLOGY ACCESS ON STUDENT’S ACADEMIC ACHIEVEMENT: AN ANALYSIS OF THE UNITED STATES

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ABSTRACT

The Covid-19 pandemic has exacerbated an academic achievement gap that has persisted despite many policies designed to combat it. Due to Covid-19 causing a rapid switch to an online-learning, many students did not have ample time to gain the resources necessary to complete their schoolwork. The lack of internet-access and computer-access disproportionately harmed the academic performance of low-income and minority students. Additionally, Rural students face significant barriers to obtain additional academic resources, and therefore, the Covid-19 lockdowns significantly harm their ability to obtain information. Based on the findings of this thesis, there is statistically significant evidence that the addition of at-home computer access, at-home internet access, and time spent utilizing a computer can benefit minorities, low-income, and students from urban communities. The findings of this thesis did not find statistically significant evidence that these resources can benefit students from rural communities. However, these results may indicate that students from rural communities need more academic direction on how to utilize online resources effectively. Therefore, policies such as temporary WI-FI enabled buses, a nationwide computer provision program, and a national initiative to inform teachers and students on how to utilize the internet effectively must be implemented to ensure students receive the benefits from access to these resources.
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The research and writing of this thesis are dedicated to everyone who helped along the way.

Many thanks,
Julie Chung
Janice Perez
Eliaquint Perez
Eliane Catilina
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Introduction

The academic achievement gap among racial and income brackets has persisted throughout the United States despite policies designed to combat it. The average black and Hispanic student is approximately two years academically behind the average white student in the United States (Dorn et al., 2010). Additionally, the average student from families whose socio-economic status is in the bottom 10th percentile is three to four years academically behind students whose family’s socio-economic status is in the 90th percentile (Hanushek et al., 2018). These disparities in achievement can cause students to have considerable discrepancies in their life trajectories.

The academic achievement gap has negative implications on the lives of minority and low-income students. Minority and low-income students have lower attainment of post-secondary degrees when compared to their counterparts which leads to a lower potential for career earnings (Libassi, 2018). Additionally, the minority students who earn a college degree tend attend the least selective and less well-resourced universities (Libassi, 2018). Due to attending the least selective and well-resource schools, African Americans and Hispanics who attend college tend to have worst career prospects than their college graduate counterparts. The academic achievement gap creates a skills gap in which low-performing students cannot find valuable employment. Since students are unable to find valuable employment, many students are funneled into a school-to-prison pipeline. 67% of people incarcerated in the United States are minorities, and 80% of people incarcerated are people from low-income communities (Mar-Shall, 2021). Many minority and low-income students are not given equal opportunities when compared to their counterparts due to a resource gap. Students cannot gain valuable skills if they do
not have the tools to learn, and thus this pushes them into a life of crime. Additionally, many of these students are not reaching their full productivity potential.

The United States economy loses potential earnings due to the achievement gap, due to the limitations on the number of skill workers (Dorn et al., 2020). The achievement gap in the United States contributes to a skills gap, where many potential workers do not reach their full potential. This lowers the United States’ potential economic output by lowering the marginal productivity of labor. Estimates in 2019 demonstrate that if African American and Hispanic students performed at the same level as white students, the United States gross domestic product would increase between 426-705 billion dollars (Dorn et al., 2020). Thus, the United States could greatly benefit its economy by ensuring all students perform to their full potential. Without counteracting the issues that contribute to this achievement gap, the lives of low-income students, minority students, and students from rural backgrounds will continue to be harmed.

Using the Education Longitudinal Study of 2002 to analyze the academic achievement gap in the United States, the present study examines the implications of lack of internet and computer access on students’ academic achievement. The academic achievement gap is the academic success disparity between students from various income brackets, racial groups, and geographical locations based on factors such as standardized tests, high school graduation rates, and grade point averages. Many factors contribute to this academic gap, but one of the primary factors contributing to this disparity is a resource gap between students. Many low-income and minority students do not have reliable access to at-home internet and at-home computer access which hinders their access to valuable online academic tools and the ability to complete their schoolwork.
This paper wishes to determine the impact of the lack of internet and computer access on various groups and deliver policy recommendations to combat the ramifications of the lack of these resources.
Background

The recent Covid-19 pandemic exposed a weakness in the infrastructure of the United States. The global pandemic forced schools to switch to a virtual-learning style, but the rapid switch in learning formats left many students unprepared. At the beginning of the pandemic, 4.4 million households with students lacked at-home computer access, and 3.7 million students lacked at-home internet access according to a survey conducted by the US Census Bureau (“More than 9 million”, 2020). The lack of broadband and computer access created a dilemma where many students could not reliably complete their schoolwork.

Students in rural communities face some of the most challenging issues in overcoming the lack of internet and computer access. Due to the vast size of the United States, the infrastructure is currently not in place for universal high-speed broadband internet. Therefore, many students do not have the option to obtain internet access in their homes. Additionally, the United States lacks universal public transit. Therefore, many students in rural communities cannot easily travel to access a computer or the internet. The lack of these necessary resources created an opportunity gap where many students from rural communities could not reliably complete their schoolwork. Many students from rural communities are forced to commute to places such as McDonald’s to access reliable internet to complete their schoolwork (Troianovski, 2013). Unfortunately, a fast-food restaurant is not an inclusive learning environment to complete schoolwork, and this disadvantages many students from rural communities. Additionally, this resource gap does not impact all people various backgrounds equally.
Students from more affluent communities tend to have more access to additional resources. According to a Pew Institute research poll conducted in April of 2020, 43% of low-income families reported that their children would likely have to use a smartphone to complete schoolwork and 40% of these students would likely have to travel to a location to use public WI-FI to complete their schoolwork (Lake & Makori, 2020). However, the same study stated that only 10% of students from upper-income families are likely to use a cellphone for schoolwork and only 6% of these students were forced to travel to a location outside their home to access public WI-FI (Lake & Makori, 2020). African American and Hispanic students are more likely to come from families in the lower-income brackets and thus they are more likely to lack these resources (Creamer, 2020). Therefore, the pandemic disproportionately disrupted the lives of low-income and minority students due to their inability to reliably complete their schoolwork. The lack of the resources will have long-term impacts on many students’ academic achievements.

The Covid-19 pandemic has left devastating effects on the academic development of students throughout the United States. For students completing only online learning during the 2020-2021 academic year, estimates depict that low-income student faced an average of 12.4 months of learning loss due to the switch to online learning compared to in-classroom learning (Dorn et al., 2020). Additionally, Hispanic students who only completed online learning faced an average of 9.2 months of learning loss, while African American students faced an average of 10.2 months of loss compared to in-classroom learning (Dorn et al., 2020). Caucasian students still faced a decrease in their academic achievement but to a lesser extent; Caucasian students who only completed online instruction during the 2020-2021 academic year lost an estimated 6.8 months of learning
compared to in-person learning (Dorn et al., 2020). Much of this loss in learning is due to the lack of quality online instruction and access to resources.

The Covid-19 pandemic forced the United States educational system to be administered in an online format. However, the United States educational system was not built to be administered this way. Many teachers were unaware of how to effectively teach through video calls, and many students lacked the internet access to effectively listen to lectures. Some students had no reliable device to access their online lectures and complete their homework. Students cannot effectively follow a lecture if the video is constantly lagging due to low-internet speeds or if their device is not reliable. Thus, many students throughout the pandemic were placed in a dilemma. They neither had access to reliable internet to listen to their lectures nor access to a reliable device to complete their schoolwork. The pandemic led to many students facing significant learning loss compared to the amount of learning that would have occurred if schools had remained open. This paper wishes to examine how much gaining at-home and computer access can benefit students who face a significant academic achievement gap.


**Literature Review**

Although a large body of research has been conducted to review the impact of lack of internet access and technology access on student achievement, less attention is directed towards students from rural backgrounds. Many studies find a statistically significant impact of these variables on student achievement. However, many of these studies fail to differentiate the impact of these variables on various racial and income groups. The study of the lack of internet access and technology is still in its infancy, but there is statistically significant evidence that the lack of factors plays a detrimental role on students’ academic achievement.

**Effects of Lack of Internet Access**

A few recent studies estimate the extent to which the lack of internet access impacts students’ academic achievement, and the results are ambiguous. A study measuring internet access's impact on test scores for 5th and 9th graders in Brazil demonstrated a small but statistically significant positive correlation between internet access and higher test scores (Melguizo et al., 2015). However, this study demonstrated that test scores were more highly dependent on a student’s socioeconomic condition than their ability to access the internet (Melguizo et al., 2015). A study conducted by students from Rice University found statistically significant evidence that improving internet access positively correlates with Texas students obtaining higher graduation rates and higher ACT/SAT test scores (Chen et al., 2021). By increasing broadband internet access in the community and internet access at schools, students could improve their academic achievement outcomes due to gaining access to more academic resources (Chen et al.,
These results both support that internet access benefits students, but the degree of that impact is still ambiguous.

Although there are ambiguous results on the impact of internet access, much of the literature tends to conclude that internet access is at-least slightly beneficial in improving student’s achievement. The literature lacks extensive research on how internet access specifically impacts rural students, minority students, and low-income students when compared to their peers in the United States.

**Effects of Lack of Technology Access**

The study of the impact of lack of computer access at home and school is still relatively new. Many studies tend to focus on college students and students from urban backgrounds. More intensive research is necessary to examine the impact of these resources on students between the grades of kindergarten to 12th grade and students from rural communities.

A recent study viewed the impact of the lack of computer access on college-age students’ academic achievement. Students at Michigan State University who did not own a computer had a significantly lower fall grade point average than students who did own a computer (Reisdorf et al., 2020). The effects of non-ownership of a laptop were significantly more negatively impactful on African American and Hispanic student’s grade point average (Reisdorf et al., 2020). However, students obtaining a post-secondary education may have professors who rely more heavily on online assignments that require a computer. Thus, this result does not indicate that a lack of computer access will have the same impact of students between the grades level of kindergarten and 12th grade.
Another study analyzed students’ achievement in an introductory economics course but found no statistically significant evidence that in-class computer use improves student’s achievement on final exams and tests (Harter & Harter, 2004). Thus, access to computers may not have a significant impact on students’ achievement. Additionally, an analysis of the one laptop per child program in Spain revealed that providing students with a laptop for at-school use decreased student’s academic performance on standardized tests (Mora et al., 2018). Although the study could not conclude why students who received computers performed worst, they hypothesized that students may become distracted by their new computer access and focus less on their academics (Mora et al., 2018). These studies provide ambiguous results that demonstrated at-home computer access may benefit students, but at-school computer access may have no impact or even harm student’s academic achievement.

Less research has been conducted to examine if the amount of time spent utilizing a computer impacts a student’s academic achievement. A study conducted on students’ cellphone usage found that as students utilized their phone for more minutes daily, their grade point average and class rank decreased (Felisoni & Godoi, 2018). Computer usage may have a similar impact due to the potential of students becoming distracted from their academic studies. Therefore, students may only need exposure to a computer for brief periods to effectively complete their schoolwork. Too much computer access may distract students and worsen their academic achievement.

Much of the literature fails to differentiate the impact of computer access on K12 age students, minority students, low-income students, and students from rural backgrounds. To fill the gap in the literature, this present study wishes to examine the
impact of at-school computer access and at-home internet access on high school aged students for various subgroups. The impact of these resources may differ between various subgroups.
Conceptual Model

Based on my review of the literature, I believe that at-home computer access and at-home internet access will have a positive correlation with a student’s academic achievement. The internet expands a student’s resources by providing them access to almost unlimited academic information (Dogruer et al., 2011). Low-income students have less disposable income and thus less opportunity to pursue additional academic resources. Therefore, I hypothesize that students from low-income backgrounds will benefit more academically from the additions of at-home computers and internet access than high-income students. Additionally, students from rural backgrounds in the United States have less access to public transportation, and thus face greater barriers to travel to obtain additional educational resources. Therefore, I hypothesize that students from rural backgrounds will have a stronger positive effect on their academic success from the addition of internet access and computer access than students from urban backgrounds.

Additionally, I hypothesize that the length of time a student spends utilizing a computer will have a hump shape relationship with student’s grade point average. Although students gained access to additional resources by gaining computer access, they also face additional distractions. Cell usage phone usage of students in Brazil had a negative correlation with students’ grade point average and class rank (Felisoni & Godoi, 2018). I believe that the relationship between computer access and a student’s grade point average is similar to the situation with cell phone usage. Although some time spent utilizing a computer is necessary to access academic resources to improve academic achievement, too much time utilizing a computer will cause distractions and lower a student’s academic achievement.
The general conceptual model of my thesis will demonstrate whether the variables at-home computer access, at-home internet access, and time spent utilizing a computer have statistically significant impact on a student’s grade point average. My model will control for factors such as socioeconomic conditions, race, geographical location, grade level, and school type that may influence academic. The general conceptual model is depicted in Figure 1.

Figure 1. Diagram of Conceptual Model
Data and Methods

The objective of this research is to examine if at-home computer access, at-home internet access, time spent utilizing a computer have a statistically significant impact on student’s academic achievement. My empirical analysis will use data from high school students to analyze the impact of these variables on students’ academic achievement. My dependent variable, grade point average, will examine the impact of my control and independent variables on a high school’s students’ academic achievement. The general model to determine the impact of these variables are as follow:

\[ GPA = \beta_0 + \beta_1 \text{ComputerAccess} + \beta_2 \text{InternetAccess} \]
\[ + \text{ComputerMins} + \beta_4 \text{Income} + \beta_5 \text{Rural or Urban} \]
\[ + \beta_6 \text{School Control} + \beta_7 \text{Grade Level} + u \]

Utilizing data from the Educational Longitudinal Study 2002-2012, my dependent variable depicts cumulative grade point average in the base year of 2002. The variable is a categorical variable depicting whether a student has a cumulative GPA between 4 categories. My main dependent variables: Computer Access, Internet Access, and Computer Minutes are all from the Educational Longitudinal study of 2002. Computer Access is a dichotomous variable depicting whether a student had internet access in the base year. The numeric value of 1 is coded to depict that a student has at-home computer access, while the value of 0 is used to depict a student who does not have computer at-home access. Internet Access is a dichotomous variable depicting whether a student had internet access in the base year. The numeric value of 1 is coded to depict that a student has at-home internet access, while the value of 0 is used to depict a student who does not
have at-home internet access. Computer Minutes is a categorical variable depicting whether a student utilized a computer for a certain number of hours for any.

To control for additional factors that may impact a student’s academic achievement and to determine the impact of these variables on various subgroups, my model includes the following variables: Urban or Rural, Income, School Control, Grade Level, and Race. Urban or Rural is a dichotomous variable depicting whether a student attended a school in a rural or urban community in the base year. Income is a categorical variable depicting the total family income from all sources in 2001. 2001 was the year before the base year when the data was first collected. School control is a dichotomous variable to determine if a student attended a public or private school. The numeric value of 1 is coded to depict that a student has attended a public school, while the value of 0 is used to depict a student attended a private school. This variable was included to control for a school’s type. Private schools in the United States tend to have different factors impacting student achievement such as more stringent discipline and higher academic engagement with students due to their smaller class sizes compared to public schools (Cookson, 1997). Thus, students attending these schools may have outside factors influencing their academic achievement and this study must control for these variables. Additionally, grade level was included to further control for these outside factors influencing academic achievement. Grade level is a categorical variable depicting which grade level a student is in the base year. As students progress throughout high school, they are allowed to take more electives and have more chances to improve their cumulative grade point average. Thus, a student’s grade level will highly influence their grade point average and this variable must be included in our model to control for this
Finally, our model includes a Race variable to determine the impact of these factors on Caucasian and Minority students. Race is a dichotomous variable depicting whether a student is a racial minority or a Caucasian student. The numeric value of 1 is coded to depict that a student is Caucasian, while the value of 0 is used to depict whether a student is a racial minority. A summary of these variables is listed below in Table 1.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>Categorical variable depicting a student’s cumulative high school grade point average</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>ComputerAccess</td>
<td>Dichotomous variable indicating if a student had computer-access at home</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>InternetAccess</td>
<td>Dichotomous variable indicating if a student had internet-access at home</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>ComputerMins</td>
<td>Categorical variable indicating how many minutes a student utilized a computer weekly</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>Urban Or Rural</td>
<td>Dichotomous variable depicting if a student attends a school in a rural community or Urban Community</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>Income</td>
<td>Categorical variable depicting if a student is from a low-income or high-income family</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>School Control</td>
<td>Dichotomous variable depicting if a student attends a private or public school</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>Grade Level</td>
<td>Categorical variable depicting a student’s highest grade level attempted</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
<tr>
<td>Race</td>
<td>Dichotomous variable depicting if a student attends a school if a minority or</td>
<td>Educational Longitudinal Study of 2002</td>
</tr>
</tbody>
</table>
Results

By using a categorical variable to represent cumulative grade point average, my data analysis depicts that at-home computer access (.0963), at-home internet access (.145), and increasing hours of utilizing a computer for any reason (.0172) when controlling for family income, school type, and a student’s grade level all have a positive effect on rural student’s cumulative grade point average. Out of my three main independent variables, none of these variables are statistically significant at the 5% level. Thus, I am unable to confirm that internet access, computer access, and time utilizing a computer have a statistically significant impact on rural students’ cumulative grade point average. Results are depicted in Table 2 below.

Table 2. Rural vs Urban Results

<table>
<thead>
<tr>
<th>Impact on Student’s Grade Point Average</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Standard Error</td>
</tr>
<tr>
<td>Family has access to the Internet</td>
<td>0.096314</td>
<td>0.1087982</td>
</tr>
<tr>
<td>Family has a computer</td>
<td>0.1449546</td>
<td>0.1322825</td>
</tr>
<tr>
<td>Frequency of computer use for all purposes (hours/day)</td>
<td>0.0283967</td>
<td>0.0172003</td>
</tr>
<tr>
<td>Total family Income</td>
<td>.1216313***</td>
<td>0.0155365</td>
</tr>
<tr>
<td>School Type (Public or Private)</td>
<td>-.2991566*</td>
<td>0.1472752</td>
</tr>
<tr>
<td>Highest grade level attempted</td>
<td>.7483284***</td>
<td>0.0638476</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.5999079</td>
<td>0.3573261</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.1364949</td>
<td>0.2045886</td>
</tr>
<tr>
<td>Observations</td>
<td>1833</td>
<td>3154</td>
</tr>
</tbody>
</table>

Out of my three main independent variables, at-home computer access has the strongest impact on a student’s grade point average. Students gain numerous resources with the addition of a computer, and this allows them to work more efficiently. At-home computer access may allow students an outlet to organize and access their notes for various classes more effectively. At-home internet access has the second greatest
positively correlated effect on a students’ grade point average. A student can use internet access to access additional academic resources and thus gain additional knowledge. The internet provides students with essentially free tutoring by providing them access to various academic instructional videos and websites dedicated to learning. Lastly, every additional hour utilizing a computer up to eight hours for any reason has the smallest impact on students’ achievement. This may be due to students utilizing a computer for non-academic reasons. Students may only need a small amount of time to complete their homework and spend the remaining time surfing the internet or playing computer games. These extra distractions may limit the positive impact of students utilizing a computer.

When comparing the impact of these three variables between students that attend schools in urban areas and rural areas, students in urban areas tend to benefit more from gaining access to computers, internet access, and the hours they are utilizing a computer. Additionally, the results for urban students demonstrated that at-home internet access, computer access, and time spent utilizing a computer all have a statistically significant impact on a student’s grade point average. This may be because students in urban areas have teachers who assign more additional homework that utilizes the internet and computers than students in rural areas. Students from rural areas tend to lack these resources and thus teachers may not effectively guide them on how to utilize the academic resources on the internet. Due to these students having more direction on how to utilize the internet efficiently, they may benefit more from the addition of these resources. Rural students may not have enough information or guidance to access all the beneficial resources the addition of at-home computers and internet access can provide them.
When comparing the impact of gaining at-home internet access, at-home computer access, and the frequency of utilizing a computer between Caucasian and minority students, the impact of the addition of these variables is much more prominent for minority student. All three of my main independent variables are statistically significant at the 5% level for minority students and thus, this thesis can conclude these variables do impact a minority student’s cumulative high school grade point average. However, only at-home computer access and frequency of utilizing a computer are statistically significant at the 5% level for Caucasian students. Thus, I am unable to conclude that family internet access has a statistically significant impact on a Caucasian student’s achievement. Results are depicted below in Table 3.

Table 3. Caucasian vs Minority Results

<table>
<thead>
<tr>
<th>Impact on Student’s Grade Point Average</th>
<th>Caucasian</th>
<th>Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family has access to the Internet</td>
<td>0.0594433</td>
<td>0.2308827***</td>
</tr>
<tr>
<td>Family has a computer</td>
<td>0.3049346***</td>
<td>0.2923902***</td>
</tr>
<tr>
<td>Frequency of computer use for all purposes (hours/day)</td>
<td>0.0296358**</td>
<td>0.0707124***</td>
</tr>
<tr>
<td>Total family income</td>
<td>0.1010419***</td>
<td>0.0771558***</td>
</tr>
<tr>
<td>School Type (Public or Private)</td>
<td>-0.1620642***</td>
<td>-0.1706418**</td>
</tr>
<tr>
<td>Highest grade level attempted</td>
<td>0.7893608***</td>
<td>0.7550276***</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.8034283***</td>
<td>-1.059425***</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.1061989</td>
<td>0.1766772</td>
</tr>
<tr>
<td>Observations</td>
<td>6110</td>
<td>3789</td>
</tr>
</tbody>
</table>

As stated previously, an academic gap has persisted between students from various races. Much of the academic achievement gap can be attributed to a resource gap; Caucasian students tends to have more wealth and thus more access to academic resources. When comparing the impact of at-home internet access, computer access, and time utilizing a computer between minority students and Caucasian students, the positive impact of
gaining these resources is much more prominent for minority students. The addition of
these resources may benefit minority students more due to the various additional resources
they gain by acquiring these resources. Caucasian students may already have access to in-
person tutoring or additional academic resources, and thus the free tools the internet
provides do not benefit them as much. However, the free tools may provide minority
students the additional resources they need to be successful in their academic endeavors.

When comparing the impact of at-home internet access, at-home computer access,
and time utilizing a computer between students from high-income families (above
$50,000 USD) and low-income families (below $50,000 USD), the impact of the addition
of these variables is greater for low-income students. For low-income students, only at-
home family internet access and the at-home computer access have a statistically
significant impact on a students’ grade point average at the 5% level. Thus, I am unable
to confirm that the frequency of utilizing a computer has a statistically significant impact
on lower-income student’s academic achievement. For higher-income students, only the
frequency of utilizing a computer and at-home computer access have a statistically
significant impact on a students’ grade point average at the 5% level. Thus, I am unable
to confirm that at-home internet access has a statistically significant impact on lower-
income students’ academic achievement. Results depicted below in table 4.
### Table 4. Low-Income vs High-Income Results

<table>
<thead>
<tr>
<th>Impact on Student’s Grade Point Average</th>
<th>Income Below $50,000 USD</th>
<th>Income Above $50,000 USD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Standard Error</td>
</tr>
<tr>
<td>Family has access to the Internet</td>
<td>.2540563**</td>
<td>0.0811999</td>
</tr>
<tr>
<td>Family has a computer</td>
<td>.4971977***</td>
<td>0.111832</td>
</tr>
<tr>
<td>Frequency of computer use for all purposes (hours/day)</td>
<td>0.0193325</td>
<td>0.0098859</td>
</tr>
<tr>
<td>Total family Income</td>
<td>.1691387***</td>
<td>0.0185466</td>
</tr>
<tr>
<td>School Type (Public or Private)</td>
<td>-.0980078*</td>
<td>0.0382224</td>
</tr>
<tr>
<td>Highest grade level attempted</td>
<td>.898223***</td>
<td>0.0669342</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.552663***</td>
<td>0.3903012</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.0758872</td>
<td>0.1572884</td>
</tr>
<tr>
<td>Observations</td>
<td>5238</td>
<td>2840</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, *** p<0.001

Low-income students have fewer financial resources and thus less expendable income to purchase additional academic resources. Since internet access and computer access offers low-income students additional access to numerous free online resources, these students benefit more when compared to their more privileged peers. Students from higher-income families have the additional financial resources to purchase services such as personal tutoring. Thus, they may already have access to the resources that at-home computers and internet access can provide.
Discussion

An academic achievement gap has persisted between races and socioeconomic subgroups despite many policies to combat this issue. Due to the recent Covid-19 pandemic, many students were forced to switch to an online learning format. Unfortunately, many students did not have at-home computers and internet access. The lack of these resources has contributed to the widening of the academic achievement gap. Temporary policies throughout the nation have been enacted to temporarily ease the negative impact of the Covid-19 pandemic on academic performance.

Similar to the previous research, this paper has shown statistically significant results that at-home and computer access can benefit students academically. Thus, many temporary policies have been enacted throughout the pandemic to provide these resources to students. Some towns flew WIFI-enabled drones to provide students in rural areas temporary at-home internet access (Langfellow, 2021). Many communities have switched to a policy of providing every student with a computer to ensure no student faces a technology gap during the pandemic (Rauf, 2020). President Biden and congress have even added a provision in the Infrastructure Investment and Jobs Act to construct the necessary infrastructure expansion to ensure all students in the United States have access to high-speed internet. However, this necessary infrastructure will take years to complete. These policies listed can limit the impact of the resource gap, but they are not universal. Only some communities have created sufficient policies to address the lack of these resources, and many communities have already ended their temporary programs. Our nation must create policies to bridge the gap until the completion of the necessary infrastructure and create lasting policies to ensure no child is left behind academically.
Although my results depict that students from urban areas tend to benefit more from at-home computer access and at-home internet access than students from rural areas, my results depict that all student subgroups benefit from adding these resources. Although the infrastructure to expand universal broadband is currently being developed through the Infrastructure Investment and Jobs Act, this infrastructure will take years to complete. To bridge the gap until the completion of this much-needed infrastructure, I recommend that school districts throughout the United States invest in WI-FI Enabled Buses. These buses act as mobile hotspots and can be placed in various locations to provide temporary internet access to students. These buses should be placed in popular safe community areas such as parks in rural areas. Students from denser populated areas can have these buses parked near highly populated areas. By providing these WI-FI-enabled buses, students will either gain the ability to access the internet at their homes or at least in a safe community area. This should allow students more options to access the resources the internet provides and complete their schoolwork. Additionally, these students must be provided with a laptop to access these resources.

As stated previously, there is a resource gap between certain subgroups of Americans. Minorities, low-income students, and students in rural areas tend to have less access to a computer at-home. However, there is statistically significant evidence that the addition of this resource and the utilization of computers can benefit students’ academic achievement. Therefore, I am proposing that school districts around the United States shift from utilizing physical textbooks to a more virtual online format. Students should be provided laptops in place of textbooks, and their required reading should be preinstalled on the device. This will allow students to easily access their required readings and
provide them with an effective method to organize their notes and complete their homework. Additionally, continued familiarization with computers is necessary in today’s digital world, and this method of requiring computer utilization will allow students to gain more hands-on experience.

Finally, a national initiative must be created to inform students on how to effectively utilize a computer and access free online resources. Although students from urban areas tend to benefit more from the addition of at-home computers and internet access, students from rural areas may just have less direction on how to properly use these resources. Thus, children throughout our schools must be properly informed of free online resources such as Kahn Academy. Additionally, teachers in rural areas must be trained on how to effectively administer assignments that utilize computers and the internet. Teachers need to be made aware of how to effectively incorporate these resources into their teaching curriculum. A national program aimed at informing students of the free resource the internet provides and providing teachers with the knowledge of how to administer assignments utilizing these resources could increase the benefits of at-home computer and internet access.

The combination of implementing these policies has the capability to close the academic achievement gap between various subgroups of our population. By not only providing a program to allow students to gain these resources but also on how to utilize these resources, our nation can close the inequitable academic achievement gap that persists. At-home internet and computer access have statistically significant positive impacts on student achievement, and our nation must find a way to allow students to access the benefits of gaining these resources.
The results of this thesis, combined with previous studies, suggest that the addition of at-home internet access, computer access, and time utilizing a computer have a positive effect on student’s academic achievement. Based on these results, I recommend the following policy recommendations: a temporary network of portable WI-FI, a state-by-state mandate for the availability of at-home computers, and a national program aimed at informing students on how to utilize the internet.
Limitations

Although my results depict statistically significant results that at-home internet access, at-home computer access, and time spent utilizing a computer have a positive impact on some students’ achievement, the age of my dataset may underestimate my results. I was unable to access a newer dataset which forced me to utilize data from the Educational Longitudinal Study of 2002-2012. However, the utilization of the internet and computers was not as universal as today’s modern world. Therefore, teachers during this time may not have assigned extensive coursework that required these materials, and there may have been fewer online tutoring services for students. Additionally, this dataset does not capture the impact of the Covid-19 pandemic on students’ achievement. The switch to online learning forced many students to require an at-home computer and internet access to complete their schoolwork and thus caused heavy reliance on these resources. Therefore, the results of my thesis may underestimate the effect of these resources on modern students’ academic achievement.

Another limitation of this thesis is that I was unable to examine the long-term impact of access to the internet and computers on students’ academic achievement. The dataset I utilized only examines questions pertaining to access to the internet and computers in the base year of 2002. Thus, this thesis was able unable to perform a difference-in-difference test. Access to computers and the internet may have delayed effects on students’ academic achievement. Students may need time to learn how to effectively utilize these resources and access free online materials. Thus, my dataset was unable to examine these long-term factors.
Finally, my dataset did not provide questions to specify how the internet and computer were utilized. Students may only need a small amount of computer and internet access to specifically complete their schoolwork, but variables pertaining to this issue were not included in my dataset. Thus, my thesis was unable to control for how a student utilized their at-home computer and internet access. Further research is necessary to examine the impacts of these variables on students’ academic achievement in the modern world.
Conclusion

The Covid-19 pandemic has exposed a flaw in the United States infrastructure by forcing many schools to switch to an online format. Many students did not have a reliable computer to complete their schoolwork, and many students could not obtain at-home internet access due to limitations in broadband infrastructure. The pandemic has caused significant learning loss for many students throughout the United States. Additionally, this learning loss has disproportionately harmed the academic performance of students from low-income backgrounds and minority students. This has widened the academic gap among these various subgroups.

This thesis wishes to contribute to the literature on determining methods to decrease the academic achievement gap between various subgroups. The results of this thesis depict that there is statistically significant evidence that at-home internet access, at-home computer access, and time spent utilizing a computer positively affect a student’s cumulative grade point average. Thus, policies must be enacted to provide these resources to students.

To bridge the gap until the necessary infrastructure is created to deploy universal high-speed internet access, I recommend a temporary policy of placing WI-FI enabled buses in prominent areas. This will provide students with a safe area to complete their schoolwork and provide some students the opportunity to complete their homework in their homes. Additionally, I recommend that schools throughout the country invest in providing computers instead of physical textbooks. This will allow every student to have reliable access to a computer to complete their schoolwork and allow them a reliable method to access the online resources the internet provides. Finally, I recommend that
students and teachers are provided with a nationwide training initiative to inform them on how to effectively utilize these resources. Students need to learn of the available online academic resources to effectively utilize them, and teachers need to know how to effectively administer assignments utilizing these resources. The addition of these policies can close the academic achievement gap.

Due to my dataset's age, my thesis cannot capture the full impact of at-home internet and computer access on students’ academic achievement. The pandemic may have exacerbated the necessity of these resources due to the switch to primary online learning. Additionally, my thesis cannot examine the long-term impact of these resources on students’ academic achievement. Students may need time to learn how to effectively access the online academic resources available on the internet. Thus, there may be a delayed effect of the resources on students’ academic achievement. Finally, my thesis cannot control for how the at-home internet and computer was utilized by students. Further research is necessary to fully examine the impact of at-home computer and internet access on students’ academic achievement.
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