The COVID-19 Learning Divide: How Demographics Shaped Online Learning Outcomes for High School Students

Kristine Webster
Northern Illinois University, USA

Abstract

The COVID-19 pandemic led to worldwide school closures and a sudden shift to online instruction, which adversely effected academic performance for many students. This study investigated whether demographic characteristics were associated with decreased academic outcomes among newly struggling high school students during Covid-19 online learning. Specifically, the study examined four key characteristics: 1) gender, 2) race/ethnicity, 3) low household income status, and 4) special education status. Newly struggling students were defined as those who received a D or F as their final course grade in two or more classes during the first semester of online learning in 2020, compared to one or no D or F final course grades during the same period in 2019 with in-person instruction. Data from a high school in the Midwestern United States were analyzed to compare final course grades between fall 2019 and fall 2020. Correlational analysis revealed that students from low-income households experienced a more significant decline in grades than their peers not from low-income households. These students were not only more likely to struggle, but also showed a greater increase in D and F course grades between semesters. In contrast, while special education students also saw an increase in D and F final course grades between semesters, the rise was less pronounced compared to their newly struggling sample group peers. This study highlights the impact of demographic factors on academic outcomes during the pandemic, addressing a gap in research on how specific characteristics influenced academic performance amid the shift to online learning.

Keywords: Online learning, newly struggling students, COVID-19 impact, academic regression, special education students, low-income students, racial and ethnic minority groups, gender

Webster, K. (2024). The Impact of Online Learning during the Covid-19 Pandemic on Academic Outcomes for Newly-Struggling High School Students. *Online Learning, Volume, 28*(3), (427-444). DOI: 10.24059/olj.v28i3.3680

In the spring of 2020, the World Health Organization declared the COVID-19 outbreak a global pandemic. To mitigate the spread of this novel virus, governments around the world enacted stay-at-home orders, closing nonessential businesses and schools. These school closures, many still in place at the time of this study, caused a sudden and immediate shift from traditional in-person classroom instruction to fully remote online instruction. Teachers were forced to adjust their teaching methods in a matter of days. Most districts had little opportunity to properly implement the shift to online and remote learning (Burgess & Sievertsen, 2020; Murat & Bonacini, 2020, Vu et al., 2020). This resulted in an historical and unprecedented disruption to student learning across the globe (Anger et al., 2020; Andrew et al., 2020; Burgess & Sievertsen, 2020; Grewenig et al., 2020; Murat & Bonacini, 2020; NBC News, 2020; UNESCO, 2020).

Though online learning is not new, the implementation of online learning due to the pandemic was a sudden and unexpected experience for students who normally receive in-person instruction (Yates, 2020). Furthermore, teaching shifted to online learning on an untested and unprecedented scale (Burgess & Sievertsen, 2020; Fang et al., 2023). This sudden shift expanded the challenges that were already in existence in online learning for students, resulting in an urgent, novel, and historic global implementation of online learning (Fang et al., 2023). Many parents with school-aged children are now concerned that their children have lost academic ground due to the learning disruptions caused by the COVID-19 school closures (Horowitz, 2020; Yates, 2020). The full social and academic impact of this disruption remain uncertain (Yates, 2020).

To begin to understand these impacts more fully, this study explored the demographic variables of newly struggling high school students to determine which variables, if any, were most strongly associated with decreased academic outcomes among these students because of the shift to online learning.

Review of Related Studies

Online learning has increased significantly over the last decade, with many states now requiring that high school students take at least one online course before graduating high school (Bernard et al., 2004; Hart et al., 2019; Ya Ni, 2013). Advocates of online learning believe that it has the power to break down barriers for students by offering increased flexibility in setting and learning style, convenience, and more customized learning when compared to traditional in-person instruction (Cheng Chi & Swan, 2000; Hackbarth, 1996; Harasim, 1990; Hughes, et al., 2015; Kiser, 1999; Matthews, 1999; Ya Ni, 2013). However, there are also concerns about the quality of online courses being offered and the ability of these online courses to meet the needs of students as effectively as in-person classes. Some students may struggle more in an online environment than with in-person instruction (Hara & Kling, 2000; Maki et al., 2002; Paden, 2006; Picciano et al., 2011; Shah, 2021; Ya Ni, 2013).

Despite these concerns, there is limited research that has been conducted on the effectiveness of online learning towards academic performance, particularly for K-12 students (Hart et al., 2019; Heppen, et al., 2017; Means et al., 2013; Nguyen, 2015; Paden, 2006; Paul &

Jefferson, 2019; Phipps & Merisotis, 1999; Tate & Warschauer, 2022; Ya Ni, 2013). The literature that does exist is inconsistent and, in the view of many researchers, also problematic. (Atchley et al., 2013; Brown & Wack, 1999; Driscoll et al., 2012; Hart et al., 2019; Means et al., 2013; Nguyen, 2015; Paden, 2006; Paul & Jefferson, 2019; Phipps & Merisotis, 1999; Rice & Dykman, 2018; Schachar & Neumann, 2010; Tate & Warschauer, 2022; Ya Ni, 2013). Those who find the research problematic contend that many of the research studies that have been conducted suffer from weak design, particularly in the populations used for comparisons, invalid comparisons between variables that determine cause and effect, the treatments used, samples that were not randomly selected, a less than robust validity and reliability of the instruments used to measure effects, as well as the choice of statistical techniques used to analyze the data (Bernard, et al., 2004; Paden, 2006; Phillips & Merisotis, 1999; Moore & Thompson, 1990; Nguyen, 2015). Bernard et al. (2004) contend that these design issues decrease confidence in the accuracy and generalizability of the results of these studies.

Recent research has shown that the academic performance of K-12 students who are enrolled in fully online classes is lower at statistically significant levels than K-12 students enrolled in in-person classes. Students in online courses typically perform anywhere from -0.10 to -0.30 SD lower than students enrolled in in-person courses (Tate & Warschauer, 2022). Students from low-income households, as well as minorities, experience the greatest performance gap when enrolled in an online course (Hart, et al., 2019).

Heppen (2017) conducted a study on 1,224 ninth grade students from across seventeen Chicago high schools enrolled in algebra credit recovery course. Students were randomly assigned to either an online or in-person credit recovery course. The students assigned to the online course scored lower on an algebra posttest than their in-person peers. Additionally, the online students were less likely to receive course credit and reported more difficulty with the course than their in-person peers. The online students had lower credit recovery rates, lower scores on an end-of-course algebra assessment and demonstrated less confidence in their mathematical skills than students who took an in-person credit recovery class.

An area of particular concern that has been identified in online learning is the attrition rate of online students versus students enrolled in traditional in-person classes (Rice, 2016). Student dropout rates in online learning are much higher than in a traditional in-person learning environment. The dropout rate for online courses is 10 to 20% higher than traditional classroom courses with the primary factors tending to be student academic skills, prior experience with online coursework, feedback from instructors, as well as social connections and supports (Aldowah, et al., 2020; Capra, 2011; Hogan, 1997; Herbert, 2006; McLaren, 2004; Moody, 2004; Morgan & Tam, 2006; Youngju et al., 2012). However, most of the studies that have been done on educational outcomes of online courses only include students who have completed the course. Those who were unsuccessful in the course and withdrew have generally not been included in the results. Therefore, the findings of successful educational outcomes in these studies have often been based on an exclusion of data from students who had the least positive outcomes in online courses (Hogan, 1997; Phipps & Merisotis, 1999; Youngju et al., 2012).

For example, McLaren (2004) compared persistence and performance measures from the five semesters of online and traditional sections of a required undergraduate business statistics

course. Her findings indicated that there was a significantly lower persistence and completion rate for students in the online classes as compared to those in the in-person classes. Though including attrition rate in online courses as an area where further research was needed, when sharing her findings on performance efficacy for students, she based her findings on final grades from only those students who completed the course, thereby eliminating the students for whom the online course was not effective. Based on this analysis, McLaren determined that "while there are significant differences in persistence between the two cases, accomplishment of the learning objectives, as measured by the final grade in the course for those students who persist, is independent of the mode of instruction" (p.7).

As with the majority of the research in this area, when comparing student performance, these studies focused only on those students who successfully completed the course. While this approach does provide important empirical evidence on the impact of online learning when compared with in-person learning for students who successfully complete these courses, it leaves the impacts and experiences of those students who were unsuccessful unexplored.

Previous research has demonstrated that demographic variables can have an impact on student achievement. However, due to the very new and ongoing nature of the COVID-19 pandemic, there is little research to determine if there are demographic variables that are more highly associated with academic struggle because of this shift to online learning during these school closures. Additionally, much of the research that has been published has come from countries outside of the United States and focuses primarily on college and university students. (Burgess & Sievertsen, 2020; Cole, 2008; Coleman, 1966; Kaur et al., 2010; Nasir, 2012; Sirin, 2005; Yates, 2020; Yousefi, 2010). Using the lens of demographic variables, this study explored the relationship between demographic variables and academic outcomes in a group of newly struggling high school students during the shift to online learning as a result of the COVID-19 school closures. The findings of this study can begin adding to the nascent research on the impact of online instruction during the COVID-19 pandemic on K-12 students in the United States.

Research Questions

Newly struggling students are defined in this study as those students who earned a D or F as their final course grade in two or more classes during the first semester of 2020 online learning but earned zero or one D or F final course grades during the first semester of 2019 with in-person instruction.

The purpose of the study was to explore whether particular demographic variables were associated with newly struggling students as well as to determine if there was a relationship between these demographic variables and the change in frequency of D and F final course grades.

> RQ.1:To what extent do student gender, racial/ethnic minority status, low household income status, or special education status predict a student's status as a newly struggling student?

RQ.2:Is there a significant relationship between gender, racial/ethnic minority status, low household income status, or special education status and the change in frequency of D and F final course grades for newly struggling students?

Study Design

This study followed an action-oriented design. In an action-oriented study, the research can inform practice, programs, and policies while also contributing to the broader scientific knowledge base (Small & Uttal, 2005). This methodological framework provides the researcher the opportunity to study and collaborate with stakeholders on complex, real-world issues identified by the key stakeholders. An area of concern identified by both district and building administration for this study was an increase in newly struggling high school students.

This study employed a correlational research design to assess the impact of online learning during the pandemic for newly struggling students as well as to identify patterns, themes, and significant relationships within and between demographic variables. Students' course grades for the identified semesters were collected for analysis from the district's student information system. The data were used to measure academic performance and to compare this performance between in-person learning and online learning.

Regression analysis was conducted for each of the key demographic variables in the sample group to determine if there was a significant relationship between each variable and a student's status as a newly struggling student. Additional analysis was conducted to explore if there was a significant relationship between demographic variables and the frequency of D and F final course grades.

The independent variables in this study are gender (female or male), racial/ethnic minority status (yes or no), low-income household status as measured by participation in the Federal free/reduced lunch program (yes or no), and special education status (yes or no). The dependent variables are newly struggling student status (yes or no) as determined by final course grades during the first semesters of 2019 and 2020 respectively and change in number of D and F final course grades between the 2019 and 2020 semesters.

Methodology

Study Setting

The high school selected for this study was in a suburban school district in the Midwestern United States. Prior to the COVID-19 school closures, this school did not have any fully online courses where students completed their schoolwork remotely. Two years prior to the COVID-19 school closure, the school did begin to offer two blended learning courses where students attended class in-person three days per week and had an open period the other two days of the week where they completed work online. During the first semester of the 2020-2021 school year, this school provided only online learning opportunities to students because of the COVID-19 pandemic school closures.

Population and Sample

Participants for this study were drawn from a group of just over 1,100 high school students. The participant group consisted of newly struggling students who attended the selected high school during both the 2019-2020 and the 2020-2021 school years.

The overall high school population is 80% White, 9% Hispanic, 3% Black, with less than 2% for each of the other racial groups. The high school dropout rate as well as English Learner percentage are low at 2%. 12% of the population receives special education services. The low household income rate, as determined by participation in the free/reduced lunch program, was 19%. The per-pupil expenditure was $12,920 per student.

State and local standardized testing were paused during the COVID-19 school closures resulting in a lack of availability of that data. Therefore, to identify newly struggling students, overall course grades for both the first semester of 2019, which was in-person, as well as the first semester of 2020, which was online, were analyzed. A total of 130 students (10.9% of the overall school population) met the criteria of newly struggling for this study. Table 1 presents demographic information for newly struggling students, not newly struggling students, as well as for the combined sample.

Table 1

Distribution of Demographic Characteristics for Sample

	Newly Struggling		Not Newly Struggling		Combined	
Demographic characteristic	*N*	%	*N*	%	*N*	%
Gender						
Female	57	43.8	531	52.9	588	51.8
Male	73	56.2	474	47.1	547	48.2
Total	130	100.0	1005	100.0	1135	100.0
Racial/Ethnic Minority						
No	108	83.1	836	83.2	944	83.2
Yes	22	16.9	169	16.8	191	16.8
Total	130	100.0	1005	100.0	1135	100.0
Low-Income Household						
No	90	69.2	807	80.3	897	79.0
Yes	40	30.8	198	19.7	238	21.0
Total	130	100.0	1005	100.0	1135	100.0
Special Education						
No	108	83.1	903	89.9	1011	89.1
Yes	22	16.9	102	10.1	124	10.9
Total	130	100.0	1005	100.0	1135	100.0

Statistical Analysis

For Research Question 1, a single binary logistic regression was conducted using the combined sample to determine the relationship between each demographic variable and status as a newly struggling student. For Research Question 2, the increase in the number of D and F final course grades between the two semesters was calculated for students identified as newly struggling. An ordinal logistic regression was conducted using this sample of students to determine if there was a relationship between demographic variable and increase in frequency of D and F final course grades for newly struggling students. The dependent variable for Research Question 2 consisted of seven range levels with each level indicating the difference in the number of D and F course grades between semesters. Table 2 describes the percentage of cases at each range level.

Table 2

Distribution of Between-Semester Difference in D and F Course Grade for Newly Struggling Students

Increase in Number of D and F Course Grades Between Semesters	*N*	% of Sample
1	13	10.0%
2	53	40.8%
3	23	17.7%
4	20	15.4%
5	13	10.0%
6	4	3.1%
7	4	3.1%
Total	130	100.0%

Results

Research Question 1

RQ.1: To what extent do student gender, racial/ethnic minority status, low household income status, or special education status predict a student's status as a newly struggling student?

Binary logistic regression was conducted using the full sample to assess the relationship between the demographic variables and a student's status as newly struggling. The omnibus tests of model coefficients indicated that the model with predictors fit significantly better than the null model ($\chi^2(4) = 12.65$, $p = .013$). Additionally, the Hosmer and Lemeshow test indicated good fit of the model ($\chi^2(4) = 1.75$, $p = .781$).

As can be seen in Table 3, results of this analysis indicated that there was a statistically significant, positive association between low household income status and a student's status as newly struggling ($B = 0.550$, $p = .012$). Students from a low-income household were significantly more likely to be newly struggling. No other demographic variable significantly predicted newly struggling student status.

Table 3

Logistic Regression Results Predicting Student Status as Newly Struggling

Effect	*B*	S.E.	Wald	*df*	*p*	Exp(*B*)
Constant	-2.044	0.146	196.86	1	<.00	0.130
Student Gender (Female)	-0.338	0.190	3.165	1	.075	0.713
Low Household Income (Yes)	0.550	0.220	6.269	1	.012	1.734
Racial/Ethnic Minority (Yes)	-0.190	0.259	0.542	1	.461	0.827
Special Education (Yes)	0.340	0.264	1.660	1	.198	1.680

Research Question 2

RQ.2: Is there a significant relationship between gender, racial/ethnic minority status, low household income status, or special education status and the change in frequency of D and F final course grades?

There were a total of 50 D and F final course grades out of a total of 861 final course grades for this group in 2019 and a total of 431 D and F final course grades out of a total of 812 final course grades for this group in 2020.

Using the difference between semesters variable as the dependent variable, an ordinal logistic regression was conducted to determine if there was a significant relationship between the demographic variables and the between-semester change in D and F course grades. A comparison of the regression model that included the predictors with the null model indicated that the former fit significantly better than the latter [$\chi^2(20) = 25.250$, $p = .192$]. Additionally, a chi-square test of model fit supported the regression model [$\chi^2(86) = 78.649$, $p = .701$]. The ordinal regression assumption of proportional odds was supported ($p = .192$).

As can be seen in Table 4, parameter estimates for the ordinal regression model indicated that, among newly struggling students, low household income status significantly predicted the difference in D and F final course grades between semesters ($B = 0.886$, $p = .017$). Therefore, not only were students from low-income households more likely to be a newly struggling student (as indicated by the results for RQ 2) but, among the newly struggling students, those from low-income households also showed a greater between-semester increase in the number D and F course grades than their peers from non-low-income households.

Table 4

Ordinal Regression Results Predicting Change in Frequency of D and F Final Course Grades Among Newly Struggling Students

Effect	*B*	Std. Error	Wald	*df*	*p*	Exp(*B*)
Student Gender (Female)	-0.191	0.324	0.346	1	.556	0.826
Low Household Income (Yes)	0.886	0.371	5.700	1	.017	2.426
Racial/Ethnic Minority (Yes)	0.096	0.441	0.047	1	.828	0.909
Special Education (Yes)	-1.071	0.460	5.426	1	.020	0.343

When status as a special education student was considered as predictor, results (Table 4) show that this special education status was significantly and negatively associated with an increase in the frequency of D and F final course grades between semesters [B = -1.071, p = .020]. That is, among newly struggling students, those with special education status showed a lower increase of D and F final course grades between semesters than their peers without special education status.

Among newly struggling students, there was not a statistically significant relationship between student gender or racial/ethnic minority status and the between-semester difference in the number of D and F course grades between semesters.

Discussion

The purpose of this study was to explore which demographic variables were associated with decreased academic outcomes among newly struggling high school students during the COVID-19 pandemic shift to online learning. This study focused on four key variables: gender, racial/ethnic minority status, low household income status, and special education status.

From this analysis it was determined that final course grades for students from low-income households were impacted more by the shift to online learning than they were for students who were not from low-income households. Not only were students from low-income households more likely to be newly struggling, but they also showed greater increase in D and F course grades between semesters than their sample group peers not from low-income households.

The findings from this study are especially important as they provide further evidence of the escalated impact of the COVID-19 pandemic on low-income households, as is also beginning to be evident in the broader nascent research on this topic. In a report by Dorn et al. (2020), the authors predicted that learning loss would be greatest among students from low-income households. They found that students from low-income households were less likely to have access to high quality remote learning from their school. They were also less likely to have a quiet space to work, less access to devices that were not shared, less access to high-speed internet connection and less parental academic support, all of which are key factors in providing an environment conducive to a remote online learning setting (Dorn et al., 2020; Goudeau et al., 2021).

Additionally, previous research has shown that students from low-income households were more likely to be provided fully remote online learning during the pandemic. Parolin & Lee's (2021) study that tracked more than 100,000 schools across the United States throughout the fall and winter of the 2020 school year, for example, found that full school closures with remote online learning as the only source of instruction were more common and longer lasting in schools serving primarily low household income students.

In a study of student math and reading achievement scores for more than 5 million third through eighth grade students in the 2020-2021 school year, Lewis et al. (2021) found that

achievement scores for students in high poverty schools were disproportionately impacted by the COVID-19 school closures. In fact, their research shows that students attending high-poverty schools showed more than double the declines of students attending low-poverty schools (Lewis et al., 2021).

Conversely, while special education students did see an increase in frequency of D and F final course grades between semesters, it was a significantly lower increase in frequency than their newly struggling sample group peers who did not have a special education designation. Unlike the research that exists on the impact of online learning on students from low-income households, there currently is conflicting evidence pertaining to the impact of online learning during the pandemic on students receiving special education services as well as the factors that contributed to that impact.

For example, Scott & Aquino (2020) conducted a survey of 605 higher education professionals who work with college students with disabilities to learn more about the challenges these students were experiencing with the shift to online learning during the pandemic. Over three quarters of the respondents indicated that—as was seen with students from low-income households—their special education students had difficulty obtaining the needed equipment (particularly access to high-speed internet service) to successfully make the shift to online learning. Respondents also reported that their special education students had more difficulty than their general education peers accessing their online coursework as well as more difficulty in communicating with their instructors. Each of these factors contributed to lower achievement rates for their special education students (Scott & Aquino, 2020).

Conversely, Lupas et al. (2021) studied the academic scores of two cohorts of special education students in the United States. The first cohort consisted of 85 special education students in the 2018-2019 school year prior to the pandemic. The second cohort consisted of 116 special education students in the 2019-2020 school year during the pandemic and online learning. Students in each of these cohorts were diagnosed with attention deficit hyperactivity disorder (ADHD) as the disability that qualified them for special education status. Lupas et al.'s (2021) analysis found that there was no significant difference in academic outcomes between cohorts, with both cohorts showing significant fall-to-spring academic growth. Based on these results, the authors contend that the move to remote instruction did not have a negative impact on special education students who participated in online learning during the COVID-19 pandemic.

Rice & Dykman's (2018) review of the literature further demonstrates the inconclusiveness of the research conducted on the efficacy of online learning for students with disabilities. In their review of 20 research articles published between 2014 and 2017, they identified three critical themes. First of all, while it is possible for students with disabilities to benefit from online learning, these benefits are not experienced broadly and often vary by disability type. Second of all, much of the policy and practice in online learning does not specifically address the needs of students with disabilities. Lastly, while they are willing to learn, both teachers and administrators express an inability to provide an optimal online learning environment for students with disabilities.

Rice & Dykman (2018) also identified critical gaps in the literature they reviewed. For example, very few studies included information as to whether or not students were receiving the accommodations afforded them by their IEPs with fidelity in the online environment. Additionally, there was little included about the preparation and continual professional development for teachers and administrators in effective online learning practices and pedagogy, particularly for students with disabilities.

As in Lupas et al.'s (2021) study, the current study indicates that special education students were the least impacted within the newly struggling student group. Lupas et al. (2021) posit that the condensed school day, increased flexibility in schedule and reduced academic demand may have been factors in the better-than-expected student achievement scores of special education students during online learning. However, as was evidenced in Rice and Dykman's (2018) review of the literature, further research is needed to determine the factors that contributed to the diminished detrimental impact on special education students in both Lupas et al.'s (2021) study as well as the current study to more clearly understand the impact, or lack thereof, for these students.

Conclusion

This study underscores the exacerbated educational disparities among students from low-income households in the wake of the COVID-19 pandemic. The research has shed light on the intensified challenges faced by these students during the shift to online learning. To address these disparities, it is recommended that future research focus on specific factors contributing to the increased impact of online learning on students from low-income households, thereby laying the groundwork for targeted interventions.

Moreover, policymakers and educational leaders must proactively engage with the ongoing research to inform and adapt current strategies, policies, and initiatives. Priority areas for consideration include ensuring equitable access to high-quality online learning and academic support, as well as addressing issues related to device availability and high-speed internet connections for students from low-income backgrounds.

Special attention is warranted in the realm of special education, where existing research yields mixed and conflicting results. Further investigations into the impact of online learning on special education students are imperative to both mitigate negative effects and enhance positive outcomes.

This study also highlights the need for a comprehensive exploration of the causes behind larger attrition rates in online learning environments. Understanding these underlying factors is crucial to ensure that online learning platforms are effectively meeting the diverse needs of all students.

Finally, this study has provided valuable insights into the immediate impacts of the shift to online learning, however the long-term consequences on student achievement remain a realm of uncertainty. Recognizing this, future research should include a more extensive exploration of

these enduring effects, contributing to a more nuanced understanding of the evolving educational landscape in the post-pandemic era. Continuous research is essential to inform evidence-based practices and policies that foster an inclusive and equitable learning environment for all students.

Declarations

The author declares that they have no competing interests.

This study was reviewed by the Northern Illinois University Institutional Review Board and was determined to meet the definition of human subjects research according to the federal regulations. The submission was then reviewed and approved by the Institutional Review Board through the expedited review process under Member Review procedures on 17-May-2021. The study participants' legal guardians received and signed a Parent Permission for a Minor to Participate in a Research Study form provided by Northern Illinois University and approved by both the university and the school district where the study took place. No study participants are identifiable in this article.

Acknowledgments

The author would like to express their sincere gratitude to the individuals who made this research possible. First and foremost, the author extends their appreciation to the school district, families, teachers, and students where the study took place. The information shared by them has been invaluable in advancing understanding of the subject matter.

The author is also deeply thankful to Northern Illinois University for its generous financial support through the Dissertation Completion Fellowship. This Fellowship funded a semester of the author's dissertation research from which this article was derived.

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