



## The Experiences of High School Students in Virtual Learning during the COVID-19 Pandemic in North Carolina, USA

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### ABSTRACT

On March 11th, 2020, the World Health Organization declared COVID-19 as a worldwide pandemic. Days later, students across the United States began attending school virtually. After nearly a year of learning virtually, Forsyth County schools in North Carolina reopened for those who wanted to attend school in person. As such, most students in this county have attended school online at one point or another. This paper aimed to investigate exactly how high school students adapted to the digital learning environment. For the most part, high school students prefer to learn face to face. Our analysis revealed that students missed socialization with friends and extracurricular activities the most out of the given choices. Additionally, students chose math as the subject they believed was the hardest to learn virtually. According to our survey, 95% of college-bound students want to attend college in person.

**Keywords:** *High School Students, Virtual Learning, Face-to-Face Learning, learning environment, North Carolina, COVID-19 Pandemic.*

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### INTRODUCTION

The United Nations Educational, Scientific and Cultural Organization (UNESCO) 2020 report indicated that more than 1.19 billion students, who constitute 68% of the students worldwide, experienced temporary or indefinite country wide school closures due to the response of governments across the globe to slow the spread of COVID-19. This unprecedented occurrence has impacted the lives of students, teachers, school administrators, and their families alike.

In this paper, we investigated the experiences of virtual learning as described by high school students. Therefore, we developed a questionnaire. We know that this questionnaire answered our research questions comprehensively because a student who co-authored this paper lived through the experiences of which we are researching. Therefore, she knew exactly what to ask students. The questionnaire mainly focuses on how students use their time online and what they do outside of school with family and friends. They were also asked what they found difficult about online learning, and what their respective schools could do to improve the online learning experience. We have collected data from students in grades 9 to 12, who were members of Crosby Scholars Program in Forsyth County, North Carolina. The aim of the Crosby Scholars Program is to aid students who attend public middle and high schools by means of financial, personal, and academic support. Students enrolled in the program participate in workshops to sharpen their test-taking and study skills, along with time management and conflict resolution. Students are required to complete a certain amount of community service hours, remain free of drugs, and follow the rules and regulations of their respective school. We believe that students from grades 9 to 12 are best suited for this survey because most of them are college-bound. Therefore, they tend to experience more stress and anxiety due to the expectations placed upon them compared to students from other grades. Additionally, since the sample was taken from a group of students that are more likely to attend college (Crosby Scholars is a program targeted towards those who plan to university), that also makes them more likely to have high expectations of themselves and work harder to achieve better grades to guarantee their college admission. The questionnaire was administered online from May 6th, 2021, to May 31st, 2021.

When the COVID-19 pandemic caused a nationwide school shutdown, students in Forsyth County were assigned work to complete on their own time at home with a set deadline. Since there were no classes to attend, students enjoyed their newfound freedom. However, in fall of 2020, students were expected to log onto their Zoom classes. Many students found it difficult to adapt to the new schedule. Some students were unable to gain access to the materials needed to attend the Zoom sessions, such as a microphone, camera, working laptop (or other device) and most importantly, a stable internet connection. As a result of these technology-related challenges coupled with a lack of motivation to be attentive in

their classes, many students may not have completed their work to the best of their ability and retained the material that was taught.

In a survey done by Student Experience in the Research University (SERU) which focused on undergraduate, graduate, and professional students, 76% of the respondents stated they had a lack of motivation for online learning. While online learning does provide the benefit of learning from the comfort of one's home, students often get distracted and find themselves lacking in motivation. As a result, some students may resort to cheating. According to an infographic published by olineschoolcenter.com, 32.7% of the respondents admitted to cheating in some form or another during online learning. For the most part, the involvement and success in academics of high school students will ultimately impact the college or university they will attend. This lack of interest in truly understanding one's schoolwork could have a catastrophic impact on the future of education and the future of the world.

In order to find out exactly how students feel about virtual learning and their frustrations, we asked the following questions in our questionnaire. We began by asking a question about the number of devices that they used for virtual learning. Among the respondents, 85% stated that they used one or two devices, while the remaining 15% answered three. One question inquired about the amount of time students spent on their devices completing schoolwork, which includes attending school as well. Most of the students stated that they spent 10 hours on their devices in a school day. A majority also stated that they spent 1 or 2 hours socializing with their friends. Outside of school, students in grade 10 spend the most time with their family, and students in grade 12 spend the least time.

Our survey found that students believe math to be the most difficult subject to learn virtually, followed by science, English, history, and electives. When asked what their school district could change about online learning, most of the respondents stated they wanted their teachers to be trained for online learning and they wished to spend less time on their devices. When asked which they preferred: online or in person learning, 85% responded that they liked in person learning, while the remaining students indicated they liked virtual learning.

Finally, we employed regression analysis to investigate the statistically significant differences among the students based on their grades with regards to the ownership of the devices. In addition, we used the regression model to examine the differences among students for the amount of time spent on devices in a day and the amount of time spent talking with friends on their devices with respect to their grades. The regression results revealed that students in grades 10 and 11 were less likely to own their devices than the students in 12th grade. As for spending time on devices for schoolwork, grades 10 and 11 spent less time on their devices than students in grade 9. Finally, grades 9, 10 and 11 were less likely to spend time talking to their friends on their devices than students in grade 12.

The remainder of this paper is written as follows. Section 2 offers a discussion of the extant literature on the impact of COVID-19 on the K-12 education ecosystem. It also highlights the contributions of our paper. Section 3 discusses methodology for data collection, econometric models, and results. The last section concludes the paper.

## **Literature Review**

The growing literature on virtual learning during COVID-19 can be divided in three vectors: challenges encountered by students and educators, the impact of online learning on the performance of the students, and opportunities, and threats to the education ecosystem. In what follows is a discussion on literature and a literature gap that this paper seeks to fill.

Although online learning is receiving a lot of traction because of COVID-19, the concept has been around for a long time. Peters [1] gets the credit for introducing the term "distance education." Broadly speaking, academic literature has introduced four theories of distance learning. Under a dialogue and structure theory, Wedemeyer [2] introduced various characteristics of independent learning and independent study. Moore [3] added the concept of interaction into independent learning and study processes. This concept of integrating interaction into independent learning had a dominant impact on the nascent field of online learning. Anderson, Rourke, Garrison, and Archer [4] propose three ways that teachers can adapt to online learning: design and administration of the study material, discourse facilitation, and direct instruction.

The second theory, proposed by Moore [5], discusses three types of interaction: learner-teacher, learner-content, and learner-learner. They suggest students need to understand how to effectively handle technology to use it for learning. To accomplish this, technology needs to be more user friendly. The next theory focuses on independence and collaboration. Garrison [6] proposes to integrate independent study with online learning and video conferencing. Researchers are still coming up with new theories for online learning as technology evolves. The fourth theory proposes synchronous and asynchronous methods for online learning [6].

Next, we investigate the impact of online learning on the performance of students. Cavanaugh et al.[7], studied the impact of online education on the academic achievements of K-12 students. They carried out a meta-analysis of 14 studies completed between 1999 and 2004. This study was funded by North Central Regional Educational Laboratory (NCREL). The study indicated that there is no significant difference in the performance of the students between online and in class learning. Furthermore, Russell [8] looks at 350 plus studies on distance education and concludes that the studies show that distance education is “as effective as” in -person education.

There are several studies that examine the impact of virtual learning during COVID-10. Surkhali and Garbuja [9] note that the impact of COVID-19 on exams in middle schools, high schools, and universities resulted in delays. In addition, they agreed that the temporary closure of schools gave educators and students time to get ready for virtual learning. However, they also indicated that due to the poor infrastructure of the internet in the country, coupled with the lack of digital devices and the knowledge of handling them, the challenges for online learning are immense. They further note that the education system in the country needs major changes in order to adapt to virtual learning. In a study that focused on the experiences and challenges of teachers in elementary and middle schools during COVID-19 for synchronous, asynchronous, and blended instruction from Israel posits that going forward, schools need to adapt to blended instruction on a regular basis [10]. They also state that infrastructure to support virtual learning remains a major challenge.

Wyse et al., [11] study the potential impact of COVID-19 on the performances of K-12 students on standardized tests. They conclude that students may be less prepared than usual for the academic year of 2020-2021. The paper also points out that the gaps in the grades of math and reading prior to and after the pandemic might be greatest for students in earlier grades. In the same vein, Kuhfeld et al., [12] project the potential impact of the pandemic on academic achievements due to school closures. They look at “absenteeism literature and summer learning pattern” among 5 million students. They argue that in fall 2020, the learning gains in reading would be 63 to 68 percent and in math that number would be 37 to 50 percent relative to a normal school year.

Torres et al., [13] study perceptions of the students who pursue education science at the University of Granada in Spain, with regards to the pedagogical model for virtual learning during the onset of the pandemic. The empirical results indicate “a generalized dissatisfaction” among students during the transition of teaching-learning modality. The students also indicate that they do not have adequate knowledge of various technologies such as “image editors, video, computer graphics, synchronous response system, and anti-plagiarism tools.”

Hamilton et al., [14] note that the methods put to use by teachers during online learning differed greatly based on the participation of students in their instruction, practice, and assessment. These researchers further claim that a large number of teachers elected to reduce their study materials and assessments compared to in-person instruction. Also, it has been indicated that many districts and schools across that US apparently either reduced or stopped their assessments altogether [15].

The literature review shows that for the most part, prior to COVID-19, the published studies on distance learning focus on the theories of online learning, and the challenges encountered by students and instructors. Whereas during COVID-19, the studies from all parts of the world, ranging from developed nations to underdeveloped nations, a majority of the research states that in order to implement online learning correctly, students and teachers need a reliable internet connection. Also, we observe that the methods of distance learning greatly evolve with technology.

### **Contributions of this paper**

1. To the best of our knowledge, this is a unique study that focuses on online learning adaptation of high school students. 2. The study mainly looks at virtual learning from the students’ perspective. 3. In particular, it investigates the various issues pertaining to virtual learning, namely ownership of devices, time spent on devices, and the most difficult subjects to learn online. 4. The study also finds what students want from their schools to make virtual learning more effective, productive, and comfortable.

### **Data Collection Methodology, Econometric Model, and Results**

The data collection procedure included a 14-question questionnaire about online learning during the pandemic. We asked about the likes and dislikes of online learning, how students spent their time outside of school, and the devices that they used. It was administered as a Google Form from May 6<sup>th</sup> to May 31st, 2021. The target demographic for this questionnaire was students in the 9th to 12th grades that were members of Crosby Scholars, Forsyth County, North Carolina. The objective of the Crosby Scholars Community Partnership is to assist students in public middle and high schools in terms of financial, personal, and academic support. The students enrolled in the program are expected to engage in workshops aimed at advancing their skills in the educational world. Other objectives include time management and resolution of conflict. Students are required to complete a certain amount of community service hours, maintain a

drug free life, and follow the various regulations of their respective school. Among the students, we had 52 respondents. The sample group was random. The results of the survey were not predicted beforehand; this was the first time that students across America were compelled to learn online. Therefore, we planned for the results ahead of time. This phenomenon was studied with fresh eyes.

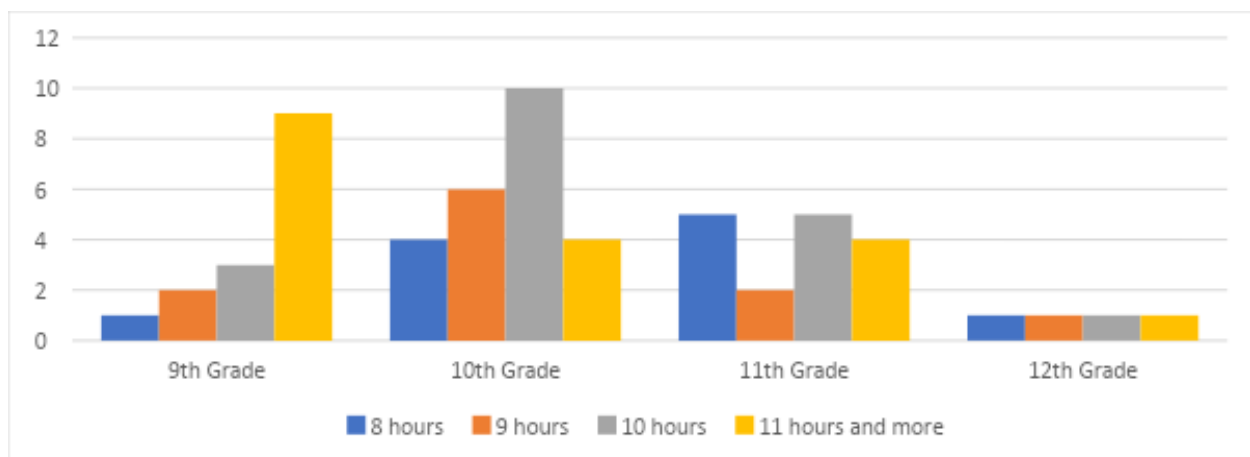
The detailed analysis of the questionnaire is as follows. Among the respondents, 75% were female, and 25% were male. 25% were in ninth grade, 41% were in tenth grade, 27% were in eleventh grade and 7% were in twelfth grade.

**Table 1: Demographics of the Respondents**

	9th grade	10th grade	11th grade	12th grade	Total
Female	22%	29%	19%	5%	75%
Male	3%	12%	8%	2%	25%
Total	25%	41%	27%	7%	100%

**Source:** Based on authors' calculations of the survey

We began by asking a question about the number of devices that students used during virtual learning. The responses indicated that 41% used only one device, 44% used two devices, and 15% used three devices. Furthermore, we asked about the ownership of these devices. The analysis indicated that 71% of the respondents owned their devices, 15% said their devices were given to them by the county, and 3% of the respondents stated that their devices belonged to their family and/or parents. The remaining 8% stated that they had one device issued by the county (laptop) and one device was their own (phone/tablet).

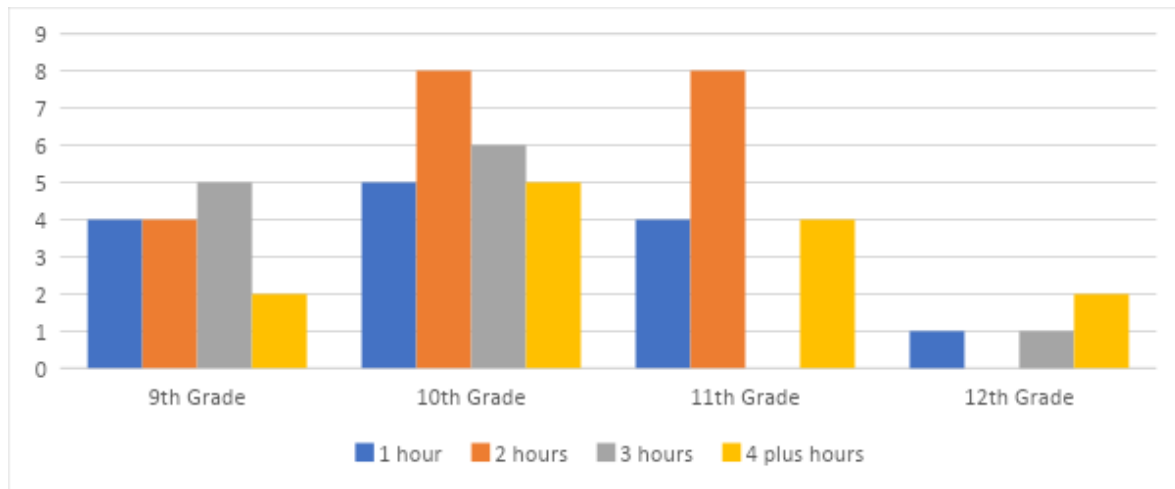


**Figure 1: Time Spent on Devices in a School Day**

**Source:** Based on authors' calculations of the survey

Next, the respondents were asked the amount of time spent on devices in a school day (see Figure 1). This includes attending school (via Zoom) and completing homework. A large number of students in 9th grade spent more than 11 hours on their devices, whereas the sophomores spent only 10 hours. Interestingly, there was a tie for 8 and 10 hours for 11th graders. For the 12th graders, the split is even across the board (1 each voted for 8, 9, 10, and 11 hours and more).

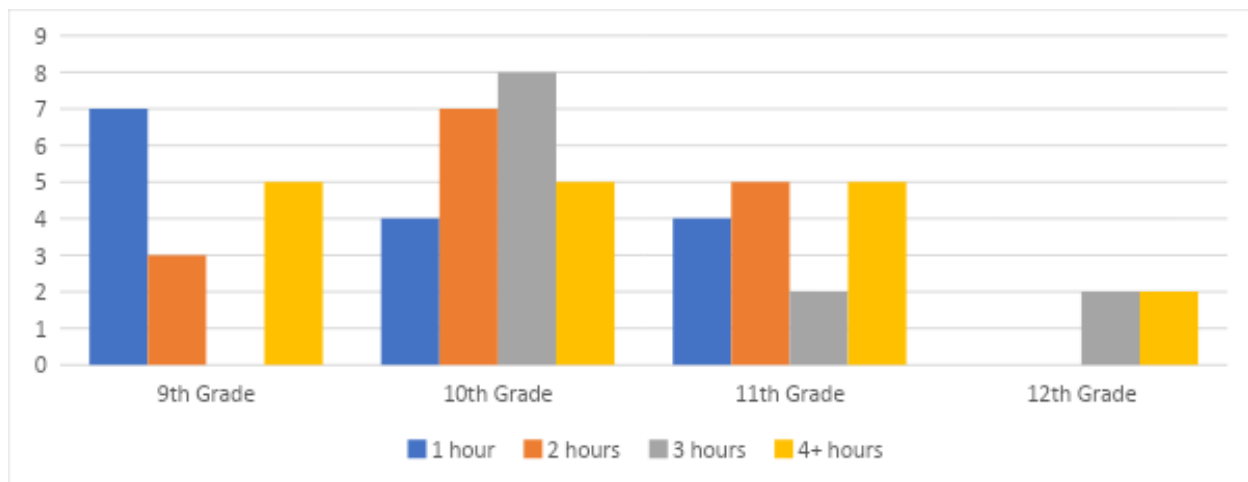
The next question asked how much time was spent with family on a weekend. 5.1% of the respondents stated they spent 1 hour with their family, 3.4% stated they spent 2 hours, 10.2% stated they spent 3 hours, 13.6% said they spent 4 hours, and 10.2% stated they spent 5 hours. Lastly, over half of the students (57.6%) said that they spent more than 5 hours with their family on the weekend. Furthermore, students were asked how much time they spent with family on a school day, and it was significantly less (see Figure 2).



**Figure 2:** *Time Spent Time with Family on a School Day*  
**Source:** Based on authors' calculations of the survey

Spending time with family has many benefits. According to the Highland Spring Clinic, spending time with family leads to better mental health, allows for children to perform better in school, and can help boost self-confidence. Family time helps to cope with stress and prepare children for the outside world. Parents are role models for children; they depend on their parents for advice, comfort and. The pandemic has brought an onslaught of new challenges for young adults, including the decline in good mental health. Spending time with one's family can help with this issue; family is there to provide support and comfort through the challenges that life presents to you. Some examples of activities children share with their parents include eating/preparing dinner (91.5%), watching a movie (66.1%), outdoor activities (55.9%), shopping (50.8%), and lastly, playing games (28.8%). As such, time spent with family is more important than ever before due to the numerous challenges students are facing related to virtual learning.

The next question asked how much time the respondents spend on their devices talking with friends (see Figure 3).



**Figure 3:** *Time Spent on Devices Talking to Friends in a School Day*  
**Source:** Based on authors' calculations of the survey

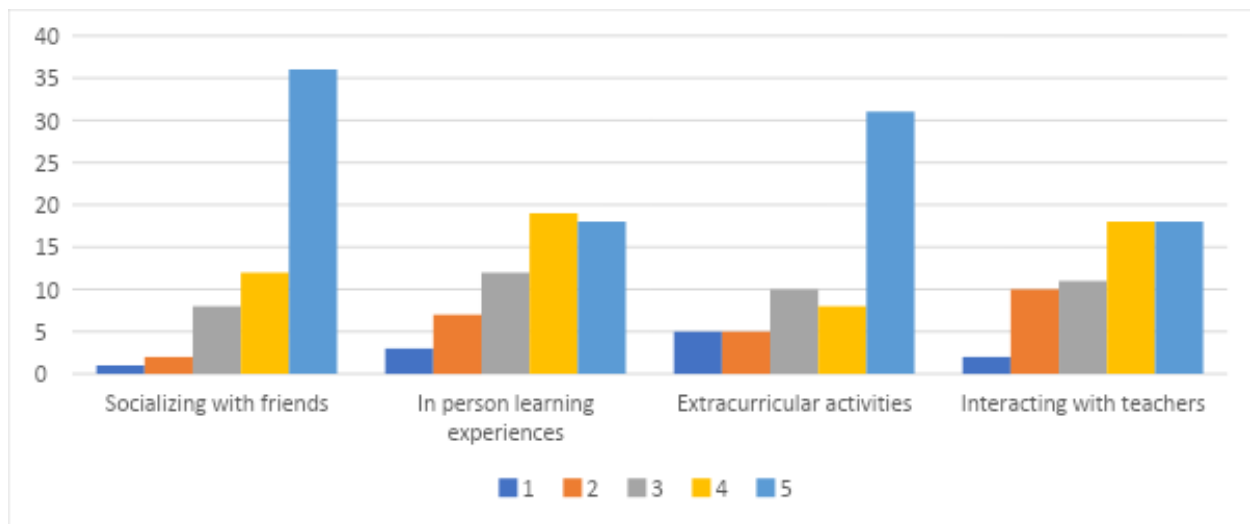
In the following question, students were asked about their parents' involvement in helping with homework. 68% stated that they didn't seek help, nor did their parents offer to help them. 31% stated that their parents helped sometimes. Lastly, 2% of the respondents stated that their parents did help them with their homework.

Next, the students were asked to rate some school- related activities from 1 to 5; 1 being the activities they miss the least, and 5 being the activities they miss the most in school (see Figure 4). Most of the students stated that they missed socializing with friends, their extracurricular activities, followed by learning experiences and interactions with their teachers.

Socializing with friends is a large part of school life. Whether it is during the breaks between classes, lunch, after school activities, or talking to friends outside of school. According to Mayo Clinic [3], "humans are social creatures by

nature.” Socializing can improve one’s well-being and happiness. It is best when done in-person, as was found by a group of researchers at Oregon Health & Science University [2]. According to their research, participants who met and talked to their friends and family at least three times a week were less likely to have depression. However, those who met and talked to their friends and family once every few months were more likely to get depression.

In addition to these benefits, students who socialize can often utilize those skills in adulthood. They tend to develop better negotiation skills and have a better understanding of handling other people, as well as themselves. School is a great place to learn about other people, especially with different backgrounds. Friends can also teach someone many life lessons, such as learning to trust, and be thankful of all life has to offer. They can push us to become better people and take risks that we would not take otherwise.



**Figure 4:** *What Do You Miss Most About In-Person Learning? (Rank from 1 to 5; 5 indicates highest and 1 indicates lowest)*

**Source:** Based on the authors’ calculations of the survey

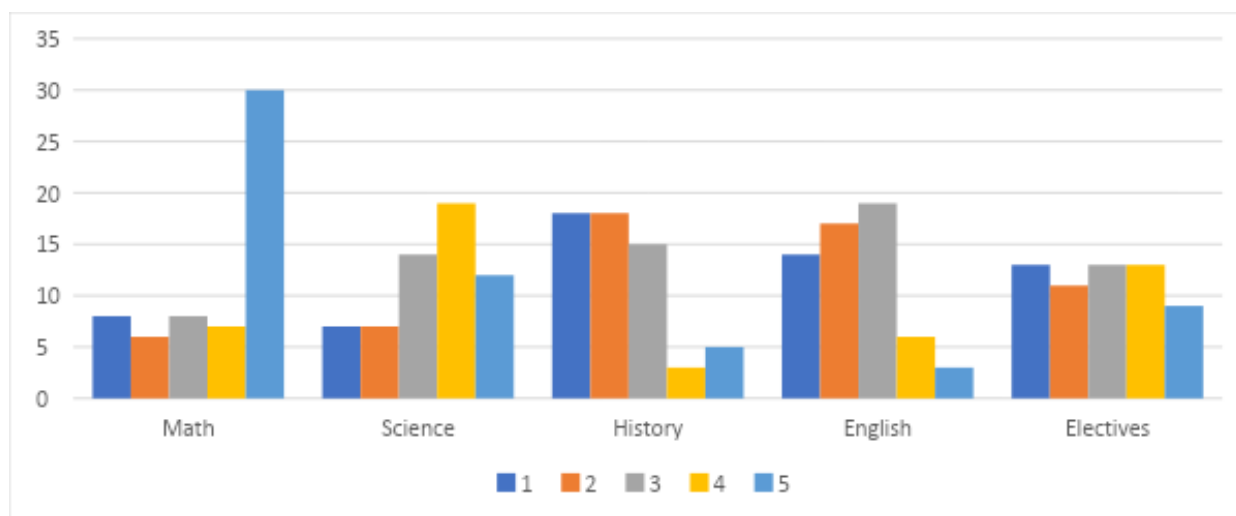
Next, the respondents stated that they missed learning experiences. Learning experiences encompass many aspects students come across in the school ecosystem. It is officially be defined as “any interaction, course, program, or other experience in which learning takes place, whether it occurs in traditional academic settings (schools, classrooms) or nontraditional settings (outside-of-school locations, outdoor environments),” according to The Glossary of Education Reform (2013). Some examples of learning experiences are performing a hands-on experiment, going on a field trip, listening to a guest speaker, or actively participating in a class discussion. During online learning, unfortunately many of these learning experiences disappeared.

Hands-on experiences can be utilized in all facets of school. According to the Santa Barbara Business College (2021), “Hands-on instruction uses kinesthetic and tactile methods, where touch, feel, smell, taste and hearing can enhance the learning experience.” For the core subjects, hands-on learning experiences take many forms. For example, in a history class, teachers can show artifacts from the time period that the students are learning about or ask them to dress up as an important figure in history. The target of these experiences is for the students to understand the topic which they are learning about in a way that they will enjoy and remember for a long time to come. The information that students assimilate from these experiences, such as useful information, and analyzing a situation are often vital skills that students can use going forward into adulthood. Going on a field trip often involves visiting other places outside of school and aims to expose students to learning outside of the classroom, involving many of the same techniques as that of hands-on experiences. Schools often invite guest speakers to give lectures and allow for students to ask questions and engage in a conversation.

Lastly, many teachers encourage students to participate in a class discussion. Students are asked to research a certain topic and come to school prepared to analyze and discuss the information they have gathered. For that reason, learning experiences are often a highlight of the overall school experience. In the online learning environment, these experiences are limited. Hands-on experiences are often transferred to simulations on the computer, which often does not have the same effect as it would in person. Field trips cannot be taken due to the ongoing pandemic. Class discussions are not as effective; students are graded by participation (the number of times they participate), rather than the content of their statements. Many students feel embarrassed to be put on the spot in class, therefore lessening the impact of the experience.

The only learning experience that is passed onto online learning that we have mentioned is guest speakers. Lectures on Zoom are less effective for the same reason that communicating with friends and family via a device is ineffective. According to the “National Education Association” (NEA), “Our brains are used to picking up body language and other cues, not to mention increases of dopamine, that are experienced during face-to-face communication.” The article further states, “On a video call, something is off, and our subconscious brain is reacting to that. Communication isn’t in real time, even though we may think it is.” Oftentimes students find lectures on Zoom to be monotonous because they are not necessarily required to pay attention and can use that time for other activities. After long periods of time, people tend to become distracted from the meeting and therefore fail to enjoy a lecture as they would in person.

Following learning experiences, students agreed that they missed extracurricular activities. According to Crimson Education, extracurricular activities allow students to explore interests outside of school, such as sports, music, or school clubs. Craft (2012) studied the impact of extracurricular activities among high school students in public schools on their grade point average (GPA), SAT scores, and attendance record. The results indicate that students who were involved in extracurricular activities had higher GPAs, SAT scores, and a better attendance record than otherwise.



**Figure 5:** Which Is the Most Difficult Subject to Learn Online? (Rank from 1 to 5; 5 indicates highest and 1 indicates lowest)

**Source:** Based on the authors’ calculations of the survey

The next question asked students to rate the difficulty of subjects from a scale of 1 to 5; 5 being the most difficult, and 1 being the easiest (see Figure 5). A majority of the students stated that math was the most difficult subject, followed by science, English, history, and electives. Math can be a very difficult subject for some people, especially in high school. It requires a good foundation, which they learn in elementary and middle school. Therefore, by the time they reach high school students forget many of the basic principles of mathematics. This includes skills such as multiplication, division, and basic formulas. When students learn advanced geometry, algebra, and calculus, there is a possibility that they tend to forget the foundation of the subject. Many students believe that math has no real purpose once they leave school; they place little value in learning it. The option selected as easiest by students, electives, includes language classes, music/art classes, or fitness classes. These subjects appeal to students, as they open the door to opportunities that have never (or rarely) been presented to them.

Many high schoolers are likely to be college bound. Due to the pandemic, students have reported a decrease in their confidence about going to college. In our study, we found that if students decide to attend college, 94.9% reported that they would attend college in-person, and the remaining 5.1% stated they wanted to attend college virtually. According to a survey conducted by America’s Promise Alliance (2021), 78% of the 11th and 12th graders (they are closer to college than the 9th and 10th graders) stated that COVID-19 has had at least a little impact on their plans after high school. 20% (one out of five) reported that the pandemic has greatly changed their plans for life after high school. In addition, some high school students fear that the pandemic has placed them in a position where they will not attend college at all. They fear that they have fallen behind in their education. In a survey conducted by the Riverside Military Academy (2020), 32% of the seniors in high school have stated that the pandemic has decreased the possibility of attending college. 40% of the seniors reported that the pandemic has caused them to not attend college at all.

The final question in the survey asked students about what their respective schools could do to make online learning easier for them. Many students asked for less time on the screen. One student stated “Honestly just not as much

homework. Even in-person, we are just staring at computer screens all day. Almost all my teachers in-person just make me log onto Zoom and they basically teach to the computer. I feel like that is already way too much screen time/blue light that we are exposing ourselves to. I feel that we don't need to continue that after school. It is not healthy for us." Other students asked for more interactive options so as to not make online learning repetitive.

One student suggested, "I would suggest taking advantage of educational apps and interactive sites such as Ed puzzle, Quizlet Kahoot, Nearpod and using virtual calming rooms as bell ringers. Such websites track attention and keep students actively engaged for longer periods of time." Some of the respondents requested more teacher-student interaction during class because, oftentimes, the teacher usually speaks and teaches to a screen without getting feedback from the students. This makes retaining information difficult and can often result in a boring class. A solution to this problem was provided by a student. They said that teachers should "Encourage students to speak up during the session." A few students believed that online learning could be made better if the teachers were prepared beforehand.

When the pandemic started, many teachers were thrust into an unfamiliar world of virtual teaching in which they had to make good use of the technological devices they had. One student stated, "The only thing to make online learning easier for me would be to instruct the teachers on how to use the tools they've been given, allot them time to become proficient in them." Many students believed that there was nothing to be done about the online learning situation. They believed that classes could continue as they were. A student stated, "I believe that my district doesn't have much ability to change anything, considering that the use of Zoom and all other online resources are used to make online school easier."

Thus far, the effects of the online-learning situation have been brought to life. However, the question of whether this method of learning and teaching is effective has yet to be answered. So exactly how effective is the virtual learning environment? According to our survey, 84.7% of the respondents prefer in person classes. While the other 15.3% is comfortable with learning virtually.

**Econometric Model**

We employed a model to study various aspects of virtual learning such as the ownership of devices, time spent on the devices for school plus homework, and time spent on communicating with friends via digital devices vis-à-vis grades of the students.

$$i = 0 + \alpha_i + \epsilon_0$$

The Winston-Salem Forsyth County School system in North Carolina issued Chrome books to students who did not have digital devices to facilitate online learning. The system also provided internet hotspots for the students who might not have an internet connection at home. As such for the ownership of devices (see Result 1, Table 2), the dependent variable *i* is interpreted as follows: "*γ*" represents a digital device and "*i*" represents the ownership status of the device. The variable takes the value of "1" if the device is owned by the student and "2" otherwise. Thus, we investigated whether there are any disparities with regards to ownership of devices and the grade of the respondents. In the survey, the students also provided information regarding the time spent on their devices for interacting with friends in a day. Thus, in Result 2 (see Table 2) the dependent variable can be interpreted as follows: the dependent variable *i* takes the value of "1" if the student spent up to 2 hours and ascribes the value of "2" if the student spent between 2 to 5 hours in a day.

Finally, the students were also asked about the time that they spent on their devices in a day, which included time spent attending school and completing homework. The results for this regression analysis are provided in Result 3 (See Table 3). In this model, the dependent variable *i* takes the value of "1" if the student spent up to 10 hours on their devices and takes the value of "2" if the time spent was more than 10 hours. The explanatory variable is the grade of the student. In the variable  $\alpha_i$ , "*α*" represents the student and "*i*" represents the grade of that student. The grades range from 9th to 12th and take the values from 1 to 4 respectively. The term 0 represents a constant in the model and the term  $\epsilon_0$  indicates the error term.

**Table 2: Ownership of Devices and Time Spent on Devices Vis-À-Vis Grade**

	<b>Result 1</b>	<b>Result 2</b>
	Dependent variable: Ownership of devices	Dependent variable: Time spent interacting with friends in a day
Independent variable: Grade [Dummy, omitted variable is grade 12th]		
Grade 9th	-0.4166 (-1.65)	-0.6666 (-2.42) ***
Grade 10th	-0.5416	-0.4583

	(-2.24) **	(-1.73) *
Grade 11th	-0.5	-0.5625
	(-2.00) **	(-2.05) **
R-squared	0.0876	0.1028
Number of observations	59	59

**Source:** Based on the authors' calculations of the survey

**Note:** t-statistics are in parentheses. \*\*\*, \*\*, and \* are statistically significant with 1, 5, and 10 percent significance levels, respectively.

As for the ownership of the devices (see Result 1, Table 2), the students in 10th and 11th grades are less likely to own their devices than the students in 12th grade. Whereas the students in 9th grade are not more or less likely to own their devices compared to the students in 12th grade. This may be because students in 12<sup>th</sup> grade are approaching college or joining the workforce, making them more likely to own their devices.

The students in 9th, 10th and 11th grades are less likely to spend time talking to their friends on their devices than the students in 12th grade (see Result 2, Table 3). We also find that the regression coefficient for the 9th grade students is the highest among the remaining two grades and the coefficient has more statistical significance than others. Because 9<sup>th</sup> graders are new to the school, they may not know as many of their classmates, and are less likely to interact with their fellow peers. Interestingly, although 10th and 11th grade students may know each other, they spent less time interacting with each other than 12th graders.

**Table 3:** *Time Spent on Devices Vis-À-Vis Grade*

<b>Result 3</b>	
Dependent variable	
Time spent on digital devices in a day	
Independent variable: Grade	
[Dummy, omitted variable Grade 9th]	
Grade 10th	-0.4333 (-2.99) ***
Grade 11th	-0.35 (-2.21) **
Grade 12th	-0.35 (-1.41)
R-squared	0.1459
Number of observations	59

**Source:** Based on the authors' calculations

**Note:** t-statistics are in parentheses. \*\*\*, \*\*, and \* are statistically significant with 1, 5, and 10 percent significance levels, respectively.

## CONCLUSIONS

In March of 2020, the coronavirus pandemic shut down schools across the world. Since then, teachers, students, and their parents have had to adapt to the new virtual learning environment. Teachers at schools were overwhelmed with the new experience, and as a result, many were unprepared to teach virtually. In this research paper, we examined the experiences and adaptations of virtual learning from the perspective of high school students by administering a survey in Forsyth County, North Carolina. The survey was conducted in May 2021.

The results of the survey revealed that most of the students used one or two devices and most spent 10 hours on their devices during a school day. Additionally, an overwhelming majority of students indicated that math was the hardest subject to learn in the virtual environment. Many of the respondents stated that they missed socializing with friends and their extracurricular activities. When asked about what their school district could do to make their learning experience better, some students concluded that they worried about the amount of time spent on their devices, while others pointed out that teachers needed to be trained for virtual learning. Finally, the econometric analysis revealed that the students in 10th and 11th grades were less likely to own their devices than the students in 12th grade. The students in 9th, 10th and 11th grades were less likely to spend time talking to their friends via their devices than the students in 12th grade. Students in 9th grade tend to spend more time on their devices for schoolwork, compared to those in 10th and 11th grade.

The responses to the open-ended question reflect the ideas and suggestions of students for online learning and that there is much room for improvement. Learning virtually is difficult for some students. They may not have a stable internet connection, or any motivation to do their work. Students find their work not as engaging as in-person school would be. As discussed earlier, online school takes away opportunities to socialize, engage in hands-on experiments, participate in extracurricular activities, and most importantly: be able to retain the information that they have learned and apply it in their lives going forward. In conclusion, online learning is all about completing the given work rather than understanding the material and using it.

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